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(54) COMPOSITION FOR HIGH-REFRACTIVE ELECTROCONDUCTIVE MATERIAL, TRANSPARENT ELECTROCONDUCTIVE MATERIAL AND REFLECTION-REDUCING MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a composition for a high-refractive electroconductive material excellent in antistaticity and capable of forming a high-refractive film, and a transparent electroconductive material and a reflection-reducing material each obtained by using the same.

SOLUTION: In the composition for a high-refractive electroconductive material comprising electroconductive fine particles (component A), dielectric fine particles having a refractive index of at least 2.0 (component B) and a binder (component C), the amounts of the component B and the component C are 5-100 pts.wt. and 5-100 pts.wt., respectively, each based on 100 pts.wt. of the component A.

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CLAIMS

[Claim(s)]

[Claim 1] The constituent for high refractive-index conductivity ingredients characterized by being the B

component 5 - the 100 weight sections, and the C component 5 - the 100 weight sections to the A component 100 weight section in a conductive particle (A component), a with a refractive indexes of 2.0 or more dielectric particle (B component), and the constituent for high refractive-index conductivity ingredients that consists of a binder (C component).

[Claim 2] The constituent for high refractive-index conductivity ingredients according to claim 1 whose conductive particle is at least one kind as which it is chosen out of the group which it becomes from indium oxide tin, tin oxide, antimony oxide tin, and zinc-oxide aluminum.

[Claim 3] The constituent for high refractive-index conductivity ingredients according to claim 1 or 2 whose dielectric particle is at least one kind as which it is chosen out of the group which it becomes from titanium oxide, cerium oxide, and a zinc oxide.

[Claim 4] The constituent for high refractive-index conductivity ingredients of any one publication of claim 1 whose whole product which a conductive particle occupies is more than a whole product that a dielectric particle occupies thru/or claim 3.

[Claim 5] The constituent for high refractive-index conductivity ingredients of any one publication of claim 1 whose binder is a binder containing a hardenability monomer thru/or claim 4.

[Claim 6] The constituent for high refractive-index conductivity ingredients of any one publication of claim 1 whose binder is a binder whose refractive index after hardening is 1.55 or more thru/or claim 5.

[Claim 7] The constituent for high refractive-index conductivity ingredients of any one publication of claim 1 whose refractive index of the high refractive-index conductivity ingredient constituent after hardening is 1.65 or more thru/or claim 6.

[Claim 8] The transparent conductive ingredient which applied the constituent for high refractive-index conductivity ingredients of any one publication of claim 1 thru/or claim 7 to the transparence base material.

[Claim 9] The transparent conductive ingredient which the constituent for high refractive-index conductivity ingredients of any one publication of claim 1 thru/or claim 7 is applied [ingredient] to a transparence base material, and makes it come to harden it.

[Claim 10] The decrease reflector which used the hardened material of the high refractive-index conductivity constituent of any one publication of claim 1 thru/or claim 7 into the decrease reflecting layer.

[Claim 11] The decrease reflector according to claim 10 whose surface-electrical-resistance value of a decrease reflecting layer is 1012ohms or less.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] electrification prevention – excelling – and high – it is related with the constituent for high refractive-index conductivity ingredients which can form the refractive index film, the transparent conductive ingredient using it, and a decrease reflector.

[0002]

[Description of the Prior Art] If the low refractive-index layer which consists of matter of a low refractive index rather than a substrate is formed in the outermost layer of drum of a transparence substrate by one fourth of the thickness (about 100nm) of light wavelength, a surface echo decreases according to cross protection, and it is known that permeability will improve.

[0003] Recently, in the field called on for reduction of the surface echo in transparence substrate parts, such as an electric product, an optical product, and building materials, the decrease reflector of multilayer which suppresses a surface echo is put in practical use by preparing one or more layers of layers from which a refractive index differs between a low refractive-index layer and a transparence substrate. The inorganic

material with the high refractive index of a metallic oxide etc. is used for the layer arranged at the interlayer of the decrease reflecting layer which constitutes this decrease reflector of multilayer.

[0004] As the formation approach of a decrease reflecting layer, the two approaches of the wet coating method (JP,7-48543,A, JP,9-314038,A) stiffened after applying to a base material desiccation and if needed are mainly learned after vapor-depositing magnesium fluoride etc. in the state of the so-called dry coating method (JP,63-261646,A) which carries out sputtering, and a homogeneity solution thru/or dispersion liquid. The former dry coating method had problems, like a large-sized facility of a high vacuum is required, and productivity is low among these. On the other hand, the latter wet coating method has little plant-and-equipment investment, and it is excellent in respect of the response to productivity and large-area-izing.

[0005] Also in a wet coating method with many advantages, the component which originates in a binder in addition to the particle of an inorganic material is contained in the layer of the high refractive index obtained eventually on the relation which once passes through a spreading process. Therefore, there was a problem to which a refractive index becomes low compared with the case where the same inorganic substance is used, by dry coating.

[0006] Moreover, in case a decrease reflector is used for an electric product or an optical product, in order to suppress adhesion of the dust to the front face by static electricity, grant of an antistatic function is called for. The conductivity of extent from which a surface-electrical-resistance value is set to 10¹²ohms or less is required for the manifestation of this antistatic function.

[0007] however, conductivity with expensive metallic oxides, such as indium oxide tin, antimony oxide tin, tin oxide, and antimony pentoxide acid zinc, – having (JP,5-290634,A, JP,11-314918,A, etc.) – it has the fault that a refractive index is low. Metallic oxides, such as the titanium oxide and cerium oxide which are used as a dielectric to it, and a zinc oxide, have the fault that conductivity is low, although a refractive index is generally high. Thus, since the metallic oxide which has both properties did not exist, it was made difficult to have conductivity by wet coating and to form the layer which is fully a high refractive index.

[0008]

[Problem(s) to be Solved by the Invention] the object of this invention – electrification prevention – excelling – and high – it is in offering the constituent for high refractive-index conductivity ingredients which can form the refractive index film, the transparent conductive ingredient using it, and a decrease reflector.

[0009]

[Means for Solving the Problem] As a result of inquiring wholeheartedly in view of said trouble, by using the high refractive-index conductivity constituent which comes to contain a conductive particle, a dielectric particle, and a binder at a specific rate, this invention persons found out that the technical problem of this invention was solvable, and completed this invention.

[0010] That is, the 1st invention is a constituent for high refractive-index conductivity ingredients characterized by being the B component 5 - the 100 weight sections, and the C component 5 - the 100 weight sections to the A component 100 weight section in a conductive particle (A component), a with a refractive indexes of 2.0 or more dielectric particle (B component), and the constituent for high refractive-index conductivity ingredients that consists of a binder (C component). The 2nd invention is the constituent for high refractive-index conductivity ingredients of the 1st invention which is at least one kind chosen from the group which a conductive particle becomes from indium oxide tin, tin oxide, antimony oxide tin, and zinc-oxide aluminum. The 3rd invention is the constituent for high refractive-index conductivity ingredients of the 1st invention which is at least one kind chosen from the group which a dielectric particle becomes from titanium oxide, cerium oxide, and a zinc oxide, or the 2nd invention. The 4th invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose whole product which a conductive particle occupies is more than a whole product that a dielectric particle occupies thru/or the 3rd invention.

[0011] The 5th invention is the 1st invention thru/or any 4th one constituent for high refractive-index conductivity ingredients which is the binder with which a binder contains a hardenability monomer. The 6th

invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose binder is a binder whose refractive index after hardening is 1.55 or more thru/or the 5th invention. The 7th invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose refractive index of the constituent for high refractive-index conductivity ingredients after hardening is 1.65 or more thru/or the 6th invention. The 8th invention is the transparent conductive ingredient which applied any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention to the transparency base material. The 9th invention is a transparent conductive ingredient which any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention is applied [ingredient] to a transparency base material, and makes it come to harden it.

[0012] The 10th invention is the decrease reflector which used the hardened material of any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention into the decrease reflecting layer. The 11th invention is the decrease reflector of the 10th invention characterized by the surface-electrical-resistance value of a decrease reflecting layer being 1012ohms or less.

[0013]

[Embodiment of the Invention] The constituents for high refractive-index conductivity ingredients of this invention are a conductive particle, a with a refractive indexes of 2.0 or more dielectric particle, and a constituent that consists of a binder. In this invention, a conductive particle can give high conductivity to the ingredient after hardening. The conductive particle used for this invention is not limited especially if the object can be attained, and it can use all well-known things. For example, metallic oxides, such as a tin oxide (refractive index 2.0), phosphorus dope tin oxide (refractive index 2.0), indium oxide tin (refractive index 2.0), antimony oxide tin (refractive index 2.1), zinc-oxide aluminum (refractive index 2.1), zinc-oxide aluminum (refractive index 2.1), and antimony pentoxide-zinc oxide (refractive index 2.0), are mentioned. In order to acquire high conductivity, tin oxide, indium oxide tin, antimony oxide tin, and zinc-oxide aluminum are mentioned preferably.

[0014] As for the refractive index of a conductive particle, it is desirable that it is 1.8 or more, it is still more desirable that it is 1.9 or more, and it is 3.0 or less. It is difficult for the refractive index of the ingredient after hardening to make it sufficiently high in less than 1.8 refractive index. The inclination which becomes difficult has atomization of the conductive matter exceeding 3.0, and it becomes less easy [atomization] to receive.

[0015] In this invention, a dielectric particle can give a high refractive index to the ingredient after hardening. The refractive index of the dielectric particle used for this invention makes it requirements to be 2.0 or more, and are 2.1 or more and 3.0 or less preferably. It is difficult for the refractive index of a constituent to be sufficiently high at less than 2.0, and for a refractive index to carry out, and the dielectric exceeding 3.0 is in the inclination for atomization to become difficult. For example, titanium oxide (refractive indexes 2.4-2.7), cerium oxide (refractive index 2.3), a zinc oxide (refractive index 2.1), a zirconium dioxide (refractive index 2.1), antimony oxide (refractive index 2.1), indium oxide (refractive index 2.0), etc. are mentioned. Preferably, titanium oxide, cerium oxide, and a zinc oxide are mentioned.

[0016] As for the mean particle diameter of the aforementioned conductive particle and a dielectric particle, it is desirable that it is below light wavelength. Since transparency falls remarkably when light wavelength was exceeded and a constituent is applied, it is not desirable. It is [0017] which is 0.1 micrometers or less still more preferably 0.2 micrometers or less especially preferably. The aforementioned dielectric particle needs to be contained in a constituent at a rate of the 5 - 100 weight section to the conductive particle 100 weight section, and is 10 - 70 weight section preferably [it is desirable and] to 10 - 80 weight section and a pan. The refractive index of the ingredient after hardening is not enough in their being under 5 weight sections, and since conductivity will fall remarkably if the 100 weight sections are exceeded, it is not desirable.

[0018] As for the whole product which a conductive particle occupies, in the constituent for high refractive-index conductivity ingredients of this invention, it is desirable that it is more than the whole product that a dielectric particle occupies. The product in this whole case is the summed-up value after breaking the addition weight of each particle by each specific gravity. Specific gravity is mentioned to "the chemistry goods

of 13398" (Chemical Daily, 1998) etc. here with tin oxide (specific gravity 6.9), titanium oxide (specific gravity 3.8-4.2), cerium oxide (specific gravity 7.3), a zinc oxide (specific gravity 5.47-5.61), a zirconium dioxide (specific gravity 5.73), antimony oxide (specific gravity 5.2-5.4), etc. Since the conductivity of the ingredient after hardening will fall remarkably if the conductive whole particle product becomes less than the whole dielectric particle product, it is not desirable.

[0019] Moreover, the front face of a conductive particle and a dielectric particle can be embellished by various coupling agents etc. if needed. Organic acids, such as metal alkoxides, such as a silicon compound by which the organic permutation was carried out if considered as various coupling agents, and aluminum, titanium, a zirconium, antimony, a fatty acid, and a phosphoric acid, the salt of those, etc. are mentioned. Moreover, lightfastness can be raised by covering the front face of a dielectric particle with oxidation silicon etc.

[0020] The spreading film can be made easy to be filled up with between particles at the time of hardening, and to form with a binder, in this invention. A binder makes requirements 5 - 100 weight **** rare ***** to the conductive particle 100 weight section, and its 10 - 90 weight **** rare ***** is desirable. Under in 5 weight sections, the degree of hardness of the ingredient after hardening falls, and if the 100 weight sections are exceeded, conductivity will fall remarkably.

[0021] It is not limited especially if this object can be attained as an ingredient used for a binder, and the organic substance, an inorganic substance, and its mixture can be used. In order to raise especially a degree of hardness, it is desirable that the hardenability monomer hardened with activity energy lines, such as heat or ultraviolet rays, and an electron ray, for a short time is included.

[0022] As an example of the aforementioned hardenability monomer, silicon compounds, such as monofunctional or polyfunctional (meta) acrylic ester, and a tetra-ethoxy silane, are mentioned, for example. As polyfunctional (meta) acrylic ester, for example, a polyfunctional alcoholic derivative, polyethylene GURIKORUJI (meta) acrylate, polyurethane (meta) acrylate, etc. are mentioned. Moreover, you may have functional groups, such as a hydroxyl group and a phosphoric ester radical, in the structure. Although especially the refractive index of said binder is not limited, in order not to lower the refractive index of the hardened ingredient, it is desirable that it is the binder whose refractive index of the binder after hardening is 1.48 or more, and it is still more desirable that it is within the limits of 1.55 or more and 1.80 or less. Since the refractive index of the ingredient which the refractive index hardened less than by 1.48 becomes low, it is not desirable. The activity of the hardenability monomer from which the refractive index of the binder after hardening becomes 1.55 or more gives [as opposed to / especially / a raise in the refractive index of the hardened ingredient] effectiveness. Acquisition of the hardenability monomer to which the refractive index of the binder after hardening will exceed 1.80 on the other hand is not easy.

[0023] What is necessary is just to have the polymerization initiation ability by UV irradiation as said photopolymerization initiator. Specifically For example, 1-hydroxy cyclohexyl phenyl ketone, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, 2-methyl-1-[4-(methylthio) phenyl]-2-mol FERINO propane-1-ON, Acetophenone system initiators, such as 1-[4-(2-hydroxy ethoxy) phenyl]-2-hydroxy-2-methyl-1-propane-1-ON; A benzoin, Benzoin system initiators, such as 2 and 2-dimethoxy -1 and 2-bibenzyl-1-ON; A benzophenone, [4-(methyl phenylthio) phenyl] phenyl meta-non, a 4-hydroxy benzophenone, Thioxan ton system initiators, such as benzophenone system initiator; 2-chloro thioxan ton [, such as 4-phenylbenzo phenon, 3, 3', 4, and a 4'-tetrapod (tert-butyl peroxide carbonyl) benzophenone], 2, and 4-diethyl thioxan ton, etc. can be mentioned. It is desirable to use the initiator which has absorption in long wavelength comparatively especially. These can be used as independent or mixture. Moreover, the approach of using together the reaction accelerator of adding the third class amines, such as p-dimethylamino ethyl benzoate ester and p-dimethylamino isoamyl benzoate ester, depending on the class of polymerization initiator may be used. As for the blending ratio of coal of a polymerization initiator, it is desirable that it is 0.01 - 20 weight section to the hardenability component 100 weight section in a binder. Since the surface hardness after hardening falls when the blending ratio of coal of an initiator exceeds under the 0.01 weight section and 20 weight sections, it is not desirable.

[0024] In the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in the constituent for high refractive-index conductivity ingredients. Especially other components are not limited and additives, such as an inorganic bulking agent, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable that a photopolymerization initiator is included. Moreover, as long as it makes it dry after membrane formation in a wet coating method, the solvent of the amount of arbitration can be added.

[0025] By applying the constituent for high refractive-index conductivity ingredients of this invention to a transparence base material, a transparent conductive ingredient can be obtained by stiffening this further.

[0026] Although not limited especially as construction material of a transparence base material, glass, polyethylene terephthalate (PET), a polycarbonate (PC), a polymethyl-methacrylate (PMMA) copolymer, triacetyl cellulose (TAC), polyolefine (PO), a polyamide (PA), a polyvinyl chloride (PVC), etc. can be mentioned preferably, for example. In light transmission, transparency here is 30% or more, and is 80% or more still more preferably 50% or more more preferably.

[0027] Although not limited especially as a configuration of a transparence base material, the thing of the shape of tabular or a film is mentioned, for example. A film-like thing is preferably mentioned from the point of productivity and transportability. As thickness of a film, a 10-500-micrometer thing is mentioned more preferably than the point of transparency and workability.

[0028] Especially the method of application of the constituent for high refractive-index conductivity ingredients of this invention to a transparence base material is not limited, but can take a well-known wet coating method. For example, the roll coat method, a spin coat method, a dip coating method, etc. are mentioned as a typical thing. In these, since the roll coat method can be formed continuously, it is more desirable than the point of productivity. Moreover, after forming a layer if needed, it can be made to harden with an exposure and heating of an activity energy line. The thickness of the transparence conductive layer which is the spreading film has desirable 0.05-20 micrometers. Since problems, such as lowering of transparency, will arise if it is difficult to acquire sufficient conductivity if thickness is set to less than 0.05 micrometers and it exceeds 20 micrometers, it is not desirable.

[0029] By this invention, the surface-electrical-resistance value of a transparence electrical conducting material can be set to 1012ohms or less, and it is 1010ohms or less still more preferably. Since the antistatic effectiveness becomes less enough when it exceeds 1012 ohms, it is not desirable.

[0030] Moreover, a transparence conductive layer and one or more layers of layers which have other functions between transparence base materials may be formed. It is not limited especially as the formation approach of a layer with other functions, but a well-known approach can be taken. For example, the wet coating method of the dry coating methods, such as vacuum evaporation and a spatter, a roll coat, a spin coat, a spray coat, etc. is mentioned. The ingredient to be used is not limited, either and one or more kinds can be made to give functions, such as improvement in a degree of hardness, anti-dazzle ** Newton ring prevention, cutoff of the light of specific wavelength, improvement in adhesion, and color tone amendment, if needed.

[0031] Moreover, since the ingredient which stiffened the constituent for high refractive-index conductivity ingredients of this invention combines a high refractive index and conductivity, it can make high optical-character ability and an antistatic function give by using as a high refractive-index layer of a decrease reflector.

[0032] When using the constituent for high refractive-index conductivity ingredients of this invention as a high refractive-index layer of a decrease reflector, it is desirable that the refractive index of the layer after hardening is 1.65 or more, and it is desirable that it is further 1.65 or more and 2.50 or less. In the thing exceeding less than 1.65 and 2.50, since optical-character ability falls, it is not desirable.

[0033] A decrease reflector can be formed as structure of having a multilayer decrease reflecting layer

containing the high refractive-index layer which hardens the constituent for high refractive-index conductivity ingredients, and is obtained on a transparency base material. For example, two-layer structure which becomes order from a low refractive-index layer and a high refractive-index layer from an outermost layer of drum; four layer systems which consist of a low refractive-index layer, a high refractive-index layer and the three-tiered structure; low refractive-index layer that consists of an inside refractive-index layer, a high refractive-index layer, an inside refractive-index layer, and a high refractive-index layer are mentioned. The thing of two-layer structure is preferably mentioned from the viewpoint of productivity, cost, and a decrease reflection effect.

[0034] Although the thickness of a decrease reflecting layer changes with configurations of the class of base material, a configuration, and a layer, the same thickness as light wavelength or the thickness not more than it is desirable per layer. For example, when the decrease reflector of two-layer expresses a decrease reflection effect to the human light, the thickness of thickness (nm) ≤ 200 of $125/nH \leq$ high refractive-index layer/ nH and a low refractive-index layer is designed for the thickness of a high refractive-index layer as thickness (nm) ≤ 165 of $100/nL \leq$ low refractive-index layer/ nL . However, nH and nL are the refractive indexes of a high refractive-index layer and a low refractive-index layer, respectively. Moreover, the thing same as a transparency base material as the aforementioned transparent conductive ingredient can be used.

[0035] in order to form a decrease reflecting layer, as a refractive index of a low refractive-index layer, the layer formed is a low refractive index from the layer [directly under] of it — things are made into requirements and, as for the refractive index, it is desirable that it is in the range of 1.40-1.55. It is difficult to form a layer hard [it is difficult to acquire decrease reflection effect sufficient in wet coating when exceeding 1.55, and] enough when it is less than 1.40. Moreover, the refractive index is not limited that what is necessary is just a layer with a refractive index lower [an inside refractive-index layer] than the high refractive-index layer which carries out a laminating, and a refractive index higher than a low refractive-index layer.

[0036] In this invention, other decrease reflecting layers except the high refractive-index layer by the constituent for high refractive-index conductivity ingredients can use a well-known thing conventionally.

[0037] As an ingredient of said low refractive-index layer, inorganic substances and fluorine-containing organic compounds, such as oxidation silicon, a fluoride lanthanum, magnesium fluoride, and cerous fluoride, can be used as independent or mixture. Moreover, a non-fluorine system monomer and a polymer can be used as a binder.

[0038] Although especially the aforementioned fluorine-containing organic compound is not limited, monomers, such as fluorine-containing (meta) acrylic ester of many organic functions, fluorine-containing itaconic-acid ester, a fluorine-containing maleate, and a fluorine-containing silicon compound, those polymers, etc. are mentioned, for example. The thing of structure which has the polymerization nature machine of monofunctional and many organic functions as a monomer is mentioned, and fluorine-containing (meta) acrylic ester is more desirable than a reactant viewpoint. An acrylic (meta) means an acrylic and/or methacrylic one here. Especially polyfunctional fluorine-containing (meta) acrylic ester is more desirable than the point of a degree of hardness and a refractive index. The layer of a low refractive index and a high degree of hardness can be made to form by stiffening these fluorine-containing organic compound.

[0039] As the aforementioned monofunctional fluorine-containing (meta) acrylic ester, 1-(meta) AKURIRO yloxy-1-perfluoroalkyl methane, 1-(meta) AKURIRO yloxy-2-perfluoroalkyl ethane, etc. are mentioned, for example. As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 8 and branching and an annular thing are mentioned.

[0040] As the aforementioned polyfunctional fluorine-containing (meta) acrylic ester, the fluorine-containing (meta) acrylic ester of two organic functions thru/or four organic functions is mentioned preferably. the — inside — two — organic functions — fluorine-containing (meta) — acrylic ester — ***** — for example — one — two — JI — (meth)acryloyloxy — three — perfluoroalkyl — butane — two — hydroxy one — one — H — one — H — two — H — three — H — three — H — perfluoroalkyl — two — ' — two — ' — a screw — {(meta) — acryloyl — oxymethyl —} — propionate — alpha — omega — JI (meta) — acryloyl — oxymethyl — perfluoro — an alkane — etc. — desirable — it can mention .

As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 11 and branching and an annular thing are mentioned, and, as for ***** and a perfluoro alkane radical, a straight chain-like thing is mentioned preferably. These JI (meta) acrylic ester can be used as independent or mixture on the occasion of an activity.

[0041] As fluorine-containing polyfunctional (meta) acrylic ester other than the further aforementioned 2 organic functions, the fluorine-containing polyfunctional (meta) acrylic ester of three organic functions and four organic functions is mentioned. this -- three -- organic functions -- fluorine-containing -- polyfunctional (meta) -- acrylic ester -- an example -- ***** -- for example -- two - (meth)acryloyloxy - one -- H -- one -- H -- two -- H -- three -- H -- three -- H - perfluoroalkyl - two -- ' -- two -- ' - a screw -- {(meta) -- acryloyl -- oxymethyl --} -- propionate -- etc. -- mentioning -- having . As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 11 and branching and an annular thing are mentioned preferably.

[0042] Moreover, as an example of the fluorine-containing polyfunctional (meta) acrylic ester of four organic functions, they are alpha, beta, gamma, and omega-tetra-(meth)acryloyloxy. - An alphaH, alphaH, betaH, gammaH, gammaH, xH, xH and yH, omegaH, and omegaH-perfluoro alkane etc. can be mentioned preferably. As for a perfluoro alkane radical, the thing of the shape of a carbon number 1 thru/or a straight chain of 14 is mentioned preferably. On the occasion of an activity, the aforementioned fluorine-containing polyfunctional (meta) acrylic ester can be used as independent or mixture.

[0043] As a concrete example of the aforementioned fluorine-containing silicon compound, trimethoxysilane (1H, 1H, 2H, 2H-perfluoroalkyl) etc. can be mentioned preferably. As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 10 and branching and an annular thing are mentioned preferably.

[0044] As a polymer of the aforementioned fluorine-containing organic compound, a straight chain-like polymers [, such as a homopolymer of the aforementioned monofunctional fluorine-containing monomer, a copolymer, or a copolymer with the monomer which does not contain a fluorine,], polymer [which includes a ring and heterocycle in a chain], annular polymer, and tandem-type polymer etc. is mentioned.

[0045] As the aforementioned non-fluorine system monomer, a well-known thing can be used conventionally. For example, silicon compounds, such as acrylic ester (meta) of monofunctional or many organic functions and a tetra-ethoxy silane, etc. are mentioned.

[0046] Moreover, in the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in decrease reflecting layers, such as a low refractive-index layer. Especially other components are not limited and additives, such as an inorganic bulking agent, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable to use a photopolymerization initiator. Moreover, as long as it makes it dry after membrane formation in a wet coating method, the solvent of the amount of arbitration can be added.

[0047] After applying and forming membranes to a base material with a wet coating method, decrease reflecting layers, such as a high refractive-index layer by the constituent for high refractive-index conductivity ingredients and a low refractive-index layer using said compound, and an inside refractive-index layer, can perform a hardening reaction if needed with an exposure and heating of heat, ultraviolet rays, an electron ray, etc. of an activity energy line, and can form a layer. Moreover, in the case of the constituent containing a solvent, a solvent can be dried before performing a hardening reaction.

[0048] What is necessary is just to have the polymerization initiation ability by UV irradiation as said photopolymerization initiator. Specifically For example, 1-hydroxy cyclohexyl phenyl ketone, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, 2-methyl-1-[4-(methylthio) phenyl]-2-mol FERINO propane-1-ON, Acetophenone system initiators, such as 1-[4-(2-hydroxy ethoxy) phenyl]-2-hydroxy-2-methyl-1-propane-1-ON; A benzoin, Benzoin system initiators, such as 2 and 2-dimethoxy -1 and 2-bibenzyl-1-ON; A benzophenone, [4-(methyl phenylthio) phenyl] phenyl meta-non, a

4-hydroxy benzophenone, Thioxan ton system initiators, such as benzophenone system initiator; 2-chloro thioxan ton [, such as 4-phenylbenzo phenon, 3, 3', 4, and a 4'-tetrapod (tert-butyl peroxide carbonyl) benzophenone], 2, and 4-diethyl thioxan ton, etc. can be mentioned. These can be used as independent or mixture. Moreover, the approach of using together the reaction accelerator of adding the third class amines, such as p-dimethylamino ethyl benzoate ester and p-dimethylamino isoamyl benzoate ester, depending on the class of polymerization initiator may be used. As for the blending ratio of coal of a polymerization initiator, it is desirable that it is 0.01 - 20 weight section to the hardenability component 100 weight section of a decrease reflecting layer. Since the surface hardness after hardening falls when the blending ratio of coal of an initiator is under the 0.01 weight section, a refractive index rises when 20 weight sections are exceeded and polymerization hardening is carried out, and a desired decrease reflecting layer cannot be formed, it is not desirable.

[0049] Said spreading can use the method of application of wet coating usually used. Specifically, the roll coat method, a dip coating method, a spin coat method, etc. are mentioned. When mass-production nature is taken into consideration, the roll coat method is desirable. It applies so that the thickness after desiccation and hardening may turn into predetermined thickness by these approaches.

[0050] For example, the class of black light used when UV irradiation performs a hardening reaction will not be limited especially if generally used, for example, a low pressure mercury lamp, a high-pressure mercury-vapor lamp, an ultrahigh pressure mercury lamp, a metal halide lamp, a xenon lamp, etc. are mentioned. As conditions for UV irradiation, 10 or more mJs of quantity of radiation are desirable, and its 100 or more mJs are still more desirable. Since sufficient surface hardness is not obtained after polymerization hardening when there is less quantity of radiation than 10mJ(s), it is not desirable. Moreover, after polymerization hardening, postcure by UV irradiation may be performed once [further] or more. As for the oxygen density at the time of UV irradiation, it is desirable to hold down the time of polymerization hardening and postcure to 1000 ppm or less by blowing inert gas, such as nitrogen and an argon.

[0051] Even after forming layers, such as a low refractive-index layer, as a surface-electrical-resistance value of a decrease reflecting layer on the layer which consists of a conductive high refractive-index constituent, it is desirable that it is 1012ohms or less, and it is still more desirable that it is 1010ohms or less. Since the antistatic effectiveness becomes less enough when it exceeds 1012 ohms, it is not desirable.

[0052] Furthermore, an one or more-layer layer can be formed between a transparence base material and a decrease reflecting layer. This layer can use an inorganic substance, the organic substance, or such mixture. The thickness has desirable 0.005-30 micrometers, and especially the formation approach of a layer is not limited. Moreover, one or more kinds of functions, such as cutoff of the light of specific wavelength, such as improvement in a degree of hardness, anti-dazzle ** Newton ring prevention, an ultraviolet-rays region, and a near infrared ray region, improvement in the adhesion between layers, and color tone amendment, can be given to these layers. When carrying out a laminating more than two-layer, a function which is different in each may be given. Grant of each function can use a well-known approach. It is desirable to prepare the rebound ace court layer especially aiming at improvement in a degree of hardness.

[0053] For example, when preparing a rebound ace court layer, an inorganic material, organic materials, or such mixture can be used. As an organic material used, hardened materials, such as silicon compounds, such as many organic functions or monofunctional acrylic ester (meta), and a tetra-ethoxy silane, are mentioned, for example. It is more desirable than the viewpoint of coexistence of productivity and a degree of hardness that it is especially the polymerization hardened material of an ultraviolet-rays hardenability polyfunctional acrylate monomer constituent.

[0054] It is not limited especially as said ultraviolet-rays hardenability polyfunctional acrylate monomer constituent, and the component of remaining as it is or others can be added, and the thing which mixed one or more kinds of well-known ultraviolet-rays hardenability polyfunctional acrylate monomers, or well-known ultraviolet-rays hardenability rebound ace court material can be used. As an ultraviolet-rays hardenability polyfunctional acrylate monomer Although not limited especially, for example Dipentaerythritol hexaacrylate,

Tetramethylolmethane tetraacrylate, tetramethylolmethane triacrylate, Pentaerythritol pentaacrylate, trimethylolpropane triacrylate, Polyfunctional alcoholic derivatives, such as 1,6-hexanediol diacrylate, 1, and 6-screw (3-acryloyloxy-2-hydroxy propyloxy) hexane, polyethylene-glycol diacrylate, polyurethane acrylate, etc. are mentioned.

[0055] In the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in a rebound ace court layer. Especially other components are not limited and additives, such as inorganic or an organic bulking agent, inorganic or an organic particle, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable to use a photopolymerization initiator. Moreover, as long as it makes it dry after membrane formation in a wet coating method, the solvent of the amount of arbitration can be added.

[0056] Moreover, especially the formation approach of a layer can be formed by the general wet coat methods, such as a roll coat and a die coat, when it is not limited but an organic material is used. The formed layer can perform a hardening reaction by the activity energy-line exposure of heating, an ultraviolet rays, an electron ray, etc., etc. if needed.

[0057] The aforementioned decrease reflector can be used for the application which needs a decrease reflection effect, high light transmission, and antistatic ability. It can use in order to suppress a surface echo of an electronic image display device especially. In using for these applications, it prepares a glue line in the field which does not form the decrease reflecting layer of a decrease reflector beforehand, and it sticks on an object and can use for it. Although not limited especially as an ingredient used for a glue line, an acrylic binder, ultraviolet curing mold adhesives, heat-curing mold adhesives, etc. can be mentioned, for example. Moreover, one or more kinds of functions, such as cutoff of the light of specific wavelength, improvement in contrast, and color tone amendment, can be given to this glue line.

[0058] As the aforementioned electronic image display device, the Braun tube, a plasma display (PDP), a liquid crystal display, etc. can be mentioned, for example. It can be made to be able to stick through a glue line and can use so that the field which does not form the decrease reflecting layer of a decrease reflector may touch the transparent material arranged in direct or a front face to this front face.

[0059]

[Example] Hereafter, based on an example, it explains to a detail further.

As an example 1 conductivity particle, 0.05 micrometers of mean diameters, a refractive index 2.0, the indium oxide tin particle of specific gravity 6.5 (It abbreviates to an ITO particle hereafter.) As the ethanol dispersion-liquid 70 weight section and a dielectric particle, 10% of the weight The mean particle diameter of 0.07 micrometers, A refractive index 2.3, the 10-% of the weight isopropanol (IPA) dispersion-liquid 30 weight section of the cerium oxide particle of specific gravity 7.3, The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tiba special tee KEMIKARUZU) 0.1 weight section were mixed as a binder, and Constituent A (the constituent A for high refractive-index conductivity ingredients) was produced.

[0060] The thickness of a layer was adjusted and applied so that the wavelength of the light which shows $\lambda/4$ for the obtained constituent A by desiccation thickness by the dip coater (Japan cedar Yamamoto physicochemistry device incorporated company make) on the acrylic board (a trade name "DERAGURASUA", Asahi Chemical Industry Co., Ltd. make) of 2mm in thickness and a refractive index 1.49 might be set to about 550nm. It hardened by irradiating [at 90 degrees C / for 1 minute] the ultraviolet rays of 400mJ after desiccation using 120W high-pressure mercury-vapor lamp under nitrogen-gas-atmosphere mind with a black light (Iwasaki Electric Co., Ltd. make), and the transparent conductive ingredient A was produced.

[0061] The refractive index after hardening of a constituent, the refractive index after hardening of a binder, and the surface-electrical-resistance value were measured by the following approaches, and the result was

shown in a table 1. The refractive index after hardening of a constituent: 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face of a transparent conductive ingredient with the sandpaper, and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). According to the following formulas 1, the refractive index was calculated from the maximum reflectance Rmax read in the reflectance spectrum.

[0062]

[Equation 1]

$$R_{\max}(\%) = \left\{ \frac{1.49 - (\text{組成物の硬化後の屈折率})^2}{1.49 + (\text{組成物の硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式1)$$

[0063] The refractive index after hardening of a binder: The sample which applied the constituent except a conductive particle and a dielectric particle to the PET film (a trade name "A4100", Toyobo Co., Ltd. make) of 188 micrometers in thickness and a refractive index 1.64, and was hardened was created. 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face with the sandpaper and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). According to the following formulas 2, the refractive index was calculated from the minimum reflection factor Rmin read in the reflectance spectrum.

[0064]

[Equation 2]

$$R_{\min}(\%) = \left\{ \frac{1.84 - (\text{バインダーの硬化後の屈折率})^2}{1.64 + (\text{バインダーの硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式2)$$

[0065] Surface-electrical-resistance value: The surface-electrical-resistance value of a transparent conductive ingredient was measured with the surface-electrical-resistance plan ("DSM8103", Toa Electronics, Ltd. make).

[0066] Constituent B (the constituent B for high refractive-index conductivity ingredients) and the transparent conductive ingredient B were produced like the example 1 except having used the 10-% of the weight ethanol dispersion-liquid 30 weight section of the titanium oxide particle of 0.04 micrometers of mean diameters, a refractive index 2.5, and specific gravity 4.9 as an example 2 dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0067] Constituent C (the constituent C for high refractive-index conductivity ingredients) and the transparent conductive ingredient C were produced like the example 1 except having used the 10-% of the weight toluene dispersion liquid of the antimony oxide tin particle (it abbreviates to an ATO particle hereafter.) of 0.05 micrometers of mean diameters, a refractive index 2.1, and specific gravity 5.2 as an example 3 conductivity particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0068] Constituent D (the constituent D for high refractive-index conductivity ingredients) and the transparent conductive ingredient D were produced like the example 1 except having used the 10-% of the weight IPA dispersion liquid of the tin oxide particle of the mean particle diameter of 0.03 micrometers, a refractive index 2.0, and specific gravity 6.9 as an example 4 conductivity particle, and having used the 10-% of the weight ethanol dispersion liquid of the zinc-oxide particle of the mean particle diameter of 0.04 micrometers, a refractive index 2.1, and specific gravity 5.5 as a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0069] Constituent E (the constituent E for high refractive-index conductivity ingredients) and the transparent

conductive ingredient E were produced for DESORAITO Z9001 (product made from JSR, Inc.) of a refractive index 1.59 like the example 1 as example 5 binder except **** for 2 weight sections. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0070] Constituent F (the constituent F for high refractive-index conductivity ingredients) and the transparent conductive ingredient F were produced like the example 1 except having used the 10-% of the weight IPA dispersion-liquid 40 weight section of a cerium oxide particle as an example 6 conductivity particle as the 10-% of the weight ethanol dispersion-liquid 60 weight section of an ITO particle, and a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0071] The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tiba special tee KEMIKARUZU) 0.1 weight section were mixed as the 10-% of the weight ethanol dispersion-liquid 100 weight section of the ITO particle of 0.05 micrometers of example of comparison 1 mean diameters, and a binder, and Constituent G (the constituent G for conductive ingredients) and the transparent conductive ingredient G were produced. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0072] The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tiba special tee KEMIKARUZU) 0.1 weight section were mixed as the 10-% of the weight isopropanol dispersion-liquid 100 weight section of the cerium oxide particle of 20.07 micrometers of examples of a comparison, and a binder, and Constituent H and the transparent material H were produced. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0073] Constituent I and the transparent material I were produced like the example 1 except having used the 10-% of the weight IPA dispersion-liquid 70 weight section of a cerium oxide particle with a mean particle diameter of 0.07 micrometers as an example of comparison 3 conductivity particle as the 10-% of the weight ethanol dispersion-liquid 30 weight section of an ITO particle with a mean particle diameter of 0.05 micrometers, and a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0074]

[A table 1]

表1

	実施例						比較例		
	1	2	3	4	5	6	1	2	3
組成物の種類	A	B	C	D	E	F	G	H	I
導電性微粒子の種類	ITO	ITO	ATO	酸化錫	ITO	ITO	ITO	—	ITO
導電性微粒子の屈折率	2.0	2.0	2.1	2.0	2.0	2.0	2.0	—	2.0
誘電体微粒子の種類	酸化セリウム	酸化チタン	酸化チタン	酸化亜鉛	酸化セリウム	酸化セリウム	—	酸化セリウム	酸化セリウム
誘電体微粒子の屈折率	2.3	2.5	2.5	2.1	2.3	2.3	—	2.3	2.3
導電性微粒子重量 /誘電体微粒子重量	100/42.9	100/42.9	100/42.9	100/42.9	100/42.9	100/66.7	100/0	0/100	100/150
導電性微粒子の総体積 /誘電体微粒子の総体積	2.5	1.4	1.5	1.9	2.6	1.8	—	—	0.7
バインダーの硬化後の屈折率	1.51	1.51	1.51	1.51	1.58	1.51	1.51	1.51	1.51
組成物の硬化後の屈折率	1.68	1.70	1.71	1.68	1.71	1.73	1.62	1.77	1.74
表面抵抗値(Ω)	2.5×10^9	8.3×10^8	2.0×10^{10}	8.0×10^{11}	6.5×10^8	3.9×10^{10}	1.1×10^9	4.5×10^{14}	2.5×10^{12}

[0075] A refractive index becomes 1.65 or more and the hardened material of the constituent in an example 1 thru/or an example 6 is a high refractive index. Moreover, the surface-electrical-resistance value is in the range of 109-1012ohm, and shows sufficient surface-electrical-resistance value for electrification prevention. To it, in the example 1 of a comparison, a refractive index is as low as 1.61, and 1014 ohms and the antistatic effectiveness are not acquired for the surface-electrical-resistance value in the example 2 of a comparison. In the example 3 of a comparison, although a refractive index is high, the antistatic effectiveness is not fully acquired.

[0076] The example 1 (low refractive-index layer coating liquid for decrease reflectors) of manufacture 1, 2, 9, 10-tetra-acryloyloxy - 4, 4, 5, 5, 6, 6, 7, and 7-octafluoro decane 50 weight section, The 30% dispersion-liquid (trade name "XBA-ST" Nissan chemistry incorporated company make) 120 weight section of silica gel particles, 2', 2'-screw (meta) (acryloyl oxymethyl) propionic acid (2-hydroxy) - 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, 10, 11, 11, and 11-nonadeca fluoro undecyl, Ten weight sections, the butyl alcohol 900 weight section, and the photopolymerization initiator (trade name "KAYACURE BMS", Nippon Kayaku Co., Ltd. make) 5 weight section were mixed, and the low refractive-index layer coating liquid for decrease reflectors was prepared.

[0077] The example 2 (rebound ace court layer coating liquid for decrease reflectors) of manufacture The dipentaerythritol hexaacrylate 70 weight section, the thoria krill acid tetramethylolmethanes 20 and 1, the 6-screw (3-acryloyloxy-2-hydroxy propyloxy) hexane 30 weight section, the photopolymerization initiator (product made from trade name "IRGACURE 184" tiba special tee KEMIKARUZU) 4 weight section, and the IPA100 weight section were mixed, and the rebound ace court layer coating liquid for decrease reflectors (HC-1) was prepared.

[0078] On the PET film (a trade name "A4100", Toyobo Co., Ltd. make) whose example 7 thickness is 188 micrometers, the rebound ace court layer coating liquid for decrease reflectors (HC-1) prepared in the example 2 of manufacture was applied so that it might become about 4 micrometers of desiccation thickness by the bar coating machine, and it hardened by irradiating the ultraviolet rays of 400mJ(s) using a black light (the Iwasaki Electric Co., Ltd. make, 120W high-pressure mercury-vapor lamp), and the rebound ace court processing PET film was produced.

[0079] It hardened by adjusting the thickness of a layer and irradiating the ultraviolet rays of 400mJ after spreading using a black light (it being 120W high-pressure mercury-vapor lamp under the Iwasaki Electric Co., Ltd. make and nitrogen-gas-atmosphere mind) so that the wavelength of the light which shows $\lambda/4$ by desiccation thickness may be set to about 550nm in the constituent A moreover prepared in the example 1 by

the dip coater (Japan cedar Yamamoto physicochemistry device incorporated company make). The decrease reflector was produced, when it applied and desiccation thickness hardened it similarly on it, respectively, after adjusting the low refractive-index layer coating liquid for decrease reflectors prepared in the example 1 of manufacture, as 550nm shows the minimum reflection factor.

[0080] The minimum reflection factor and surface-electrical-resistance value of a decrease reflector which were acquired were measured as follows. The result was shown in a table 2, respectively.

The minimum reflection factor: 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face of a conductive decrease reflector with the sandpaper, and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). And the minimal value of a reflection factor was read in the reflectance spectrum, and it considered as the minimum reflection factor.

Surface-electrical-resistance value: It measured with the surface-electrical-resistance meter ("DSM8103", Toa Electronics, Ltd. make).

[0081] The decrease reflector was produced like the example 7 except having replaced with the example 8 - the 12 constituent A, and having used the constituent (B, C, D, E, F), respectively. Moreover, measurement of the minimum reflection factor of a decrease reflector and a surface-electrical-resistance value was performed like the example 7. The result was shown in a table 2, respectively.

[0082] The decrease reflector was produced like the example 7 except having replaced with the example 4 of a comparison - the 6 constituent A, and having used the constituent (G, H, I), respectively. Moreover, measurement of the minimum reflection factor of a decrease reflector and a surface-electrical-resistance value was performed like the example 7. The result was shown in a table 2, respectively.

[0083]

[A table 2]

表2

	実施例						比較例		
	7	8	9	10	11	12	4	5	6
組成物の種類	A	B	C	D	E	F	G	H	I
組成物の硬化後の屈折率	1.88	1.70	1.71	1.66	1.71	1.73	1.82	1.77	1.74
最小反射率(%)	0.9	0.7	0.6	1.0	0.6	0.4	1.3	0.3	0.4
表面抵抗値(Ω)	3.5×10^9	7.6×10^9	1.5×10^{10}	6.5×10^{11}	8.0×10^9	4.0×10^{10}	0.8×10^9	4.4×10^{12}	3.8×10^{12}

[0084] In an example 7 thru/or an example 12, the manufactured decrease reflector has the 1% or less of the minimum reflection factors, and an antistatic function. To it, in the example 4 of a comparison, a reflection factor is high, and antistatic ability comes out enough and it turns out by the examples 5 and 6 of a comparison that there is nothing.

[0085]

[Effect of the Invention] electrification prevention – excelling – and high – the constituent for high refractive-index conductivity ingredients which can form the refractive index film is obtained. Moreover, a refractive index becomes 1.65 or more and the transparent conductive ingredient equipped with the hardened material of a high refractive-index conductivity constituent is a high refractive index. Moreover, the surface-electrical-resistance value is in the range of 10⁹-10¹²ohm, and shows sufficient surface-electrical-resistance value for electrification prevention. Moreover, the decrease reflector which used the hardened material of the constituent for high refractive-index conductivity ingredients into the decrease reflecting layer shows the 1% or less of the minimum reflection factors, and the engine performance which was excellent in the antistatic function.

TECHNICAL FIELD

[Field of the Invention] electrification prevention -- excelling -- and high -- it is related with the constituent for high refractive-index conductivity ingredients which can form the refractive index film, the transparent conductive ingredient using it, and a decrease reflector.

PRIOR ART

[Description of the Prior Art] If the low refractive-index layer which consists of matter of a low refractive index rather than a substrate is formed in the outermost layer of drum of a transparence substrate by one fourth of the thickness (about 100nm) of light wavelength, a surface echo decreases according to cross protection, and it is known that permeability will improve.

[0003] Recently, in the field called on for reduction of the surface echo in transparence substrate parts, such as an electric product, an optical product, and building materials, the decrease reflector of multilayer which suppresses a surface echo is put in practical use by preparing one or more layers of layers from which a refractive index differs between a low refractive-index layer and a transparence substrate. The inorganic material with the high refractive index of a metallic oxide etc. is used for the layer arranged at the interlayer of the decrease reflecting layer which constitutes this decrease reflector of multilayer.

[0004] As the formation approach of a decrease reflecting layer, the two approaches of the wet coating method (JP,7-48543,A, JP,9-314038,A) stiffened after applying to a base material desiccation and if needed are mainly learned after vapor-depositing magnesium fluoride etc. in the state of the so-called dry coating method (JP,63-261646,A) which carries out sputtering, and a homogeneity solution thru/or dispersion liquid. The former dry coating method had problems, like a large-sized facility of a high vacuum is required, and productivity is low among these. On the other hand, the latter wet coating method has little plant-and-equipment investment, and it is excellent in respect of the response to productivity and large-area-izing.

[0005] Also in a wet coating method with many advantages, the component which originates in a binder in addition to the particle of an inorganic material is contained in the layer of the high refractive index obtained eventually on the relation which once passes through a spreading process. Therefore, there was a problem to which a refractive index becomes low compared with the case where the same inorganic substance is used, by dry coating.

[0006] Moreover, in case a decrease reflector is used for an electric product or an optical product, in order to suppress adhesion of the dust to the front face by static electricity, grant of an antistatic function is called for. The conductivity of extent from which a surface-electrical-resistance value is set to 10¹²ohms or less is required for the manifestation of this antistatic function.

[0007] however, conductivity with expensive metallic oxides, such as indium oxide tin, antimony oxide tin, tin oxide, and antimony pentoxide acid zinc, -- having (JP,5-290634,A, JP,11-314918,A, etc.) -- it has the fault that a refractive index is low. Metallic oxides, such as the titanium oxide and cerium oxide which are used as a dielectric to it, and a zinc oxide, have the fault that conductivity is low, although a refractive index is generally high. Thus, since the metallic oxide which has both properties did not exist, it was made difficult to have conductivity by wet coating and to form the layer which is fully a high refractive index.

EFFECT OF THE INVENTION

[Effect of the Invention] electrification prevention -- excelling -- and high -- the constituent for high

refractive-index conductivity ingredients which can form the refractive index film is obtained. Moreover, a refractive index becomes 1.65 or more and the transparent conductive ingredient equipped with the hardened material of a high refractive-index conductivity constituent is a high refractive index. Moreover, the surface-electrical-resistance value is in the range of 10⁹-10¹²ohm, and shows sufficient surface-electrical-resistance value for electrification prevention. Moreover, the decrease reflector which used the hardened material of the constituent for high refractive-index conductivity ingredients into the decrease reflecting layer shows the 1% or less of the minimum reflection factors, and the engine performance which was excellent in the antistatic function.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] the object of this invention – electrification prevention – excelling – and high – it is in offering the constituent for high refractive-index conductivity ingredients which can form the refractive index film, the transparent conductive ingredient using it, and a decrease reflector.

MEANS

[Means for Solving the Problem] As a result of inquiring wholeheartedly in view of said trouble, by using the high refractive-index conductivity constituent which comes to contain a conductive particle, a dielectric particle, and a binder at a specific rate, this invention persons found out that the technical problem of this invention was solvable, and completed this invention.

[0010] That is, the 1st invention is a constituent for high refractive-index conductivity ingredients characterized by being the B component 5 - the 100 weight sections, and the C component 5 - the 100 weight sections to the A component 100 weight section in a conductive particle (A component), a with a refractive indexes of 2.0 or more dielectric particle (B component), and the constituent for high refractive-index conductivity ingredients that consists of a binder (C component). The 2nd invention is the constituent for high refractive-index conductivity ingredients of the 1st invention which is at least one kind chosen from the group which a conductive particle becomes from indium oxide tin, tin oxide, antimony oxide tin, and zinc-oxide aluminum. The 3rd invention is the constituent for high refractive-index conductivity ingredients of the 1st invention which is at least one kind chosen from the group which a dielectric particle becomes from titanium oxide, cerium oxide, and a zinc oxide, or the 2nd invention. The 4th invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose whole product which a conductive particle occupies is more than a whole product that a dielectric particle occupies thru/or the 3rd invention.

[0011] The 5th invention is the 1st invention thru/or any 4th one constituent for high refractive-index conductivity ingredients which is the binder with which a binder contains a hardenability monomer. The 6th invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose binder is a binder whose refractive index after hardening is 1.55 or more thru/or the 5th invention. The 7th invention is any one constituent for high refractive-index conductivity ingredients of the 1st invention whose refractive index of the constituent for high refractive-index conductivity ingredients after hardening is 1.65 or more thru/or the 6th invention. The 8th invention is the transparent conductive ingredient which applied any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention to the transparence base material. The 9th invention is a transparent conductive ingredient which any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention is applied [ingredient] to a transparence base material, and makes it come to harden it.

[0012] The 10th invention is the decrease reflector which used the hardened material of any one constituent for high refractive-index conductivity ingredients of the 1st invention thru/or the 7th invention into the decrease

reflecting layer. The 11th invention is the decrease reflector of the 10th invention characterized by the surface-electrical-resistance value of a decrease reflecting layer being 10¹²ohms or less.

[0013]

[Embodiment of the Invention] The constituents for high refractive-index conductivity ingredients of this invention are a conductive particle, a with a refractive indexes of 2.0 or more dielectric particle, and a constituent that consists of a binder. In this invention, a conductive particle can give high conductivity to the ingredient after hardening. The conductive particle used for this invention is not limited especially if the object can be attained, and it can use all well-known things. For example, metallic oxides, such as a tin oxide (refractive index 2.0), phosphorus dope tin oxide (refractive index 2.0), indium oxide tin (refractive index 2.0), antimony oxide tin (refractive index 2.1), zinc-oxide aluminum (refractive index 2.1), zinc-oxide aluminum (refractive index 2.1), and antimony pentoxide-zinc oxide (refractive index 2.0), are mentioned. In order to acquire high conductivity, tin oxide, indium oxide tin, antimony oxide tin, and zinc-oxide aluminum are mentioned preferably.

[0014] As for the refractive index of a conductive particle, it is desirable that it is 1.8 or more, it is still more desirable that it is 1.9 or more, and it is 3.0 or less. It is difficult for the refractive index of the ingredient after hardening to make it sufficiently high in less than 1.8 refractive index. The inclination which becomes difficult has atomization of the conductive matter exceeding 3.0, and it becomes less easy [atomization] to receive.

[0015] In this invention, a dielectric particle can give a high refractive index to the ingredient after hardening. The refractive index of the dielectric particle used for this invention makes it requirements to be 2.0 or more, and are 2.1 or more and 3.0 or less preferably. It is difficult for the refractive index of a constituent to be sufficiently high at less than 2.0, and for a refractive index to carry out, and the dielectric exceeding 3.0 is in the inclination for atomization to become difficult. For example, titanium oxide (refractive indexes 2.4-2.7), cerium oxide (refractive index 2.3), a zinc oxide (refractive index 2.1), a zirconium dioxide (refractive index 2.1), antimony oxide (refractive index 2.1), indium oxide (refractive index 2.0), etc. are mentioned. Preferably, titanium oxide, cerium oxide, and a zinc oxide are mentioned.

[0016] As for the mean particle diameter of the aforementioned conductive particle and a dielectric particle, it is desirable that it is below light wavelength. Since transparency falls remarkably when light wavelength was exceeded and a constituent is applied, it is not desirable. It is [0017] which is 0.1 micrometers or less still more preferably 0.2 micrometers or less especially preferably. The aforementioned dielectric particle needs to be contained in a constituent at a rate of the 5 - 100 weight section to the conductive particle 100 weight section, and is 10 - 70 weight section preferably [it is desirable and] to 10 - 80 weight section and a pan. The refractive index of the ingredient after hardening is not enough in their being under 5 weight sections, and since conductivity will fall remarkably if the 100 weight sections are exceeded, it is not desirable.

[0018] As for the whole product which a conductive particle occupies, in the constituent for high refractive-index conductivity ingredients of this invention, it is desirable that it is more than the whole product that a dielectric particle occupies. The product in this whole case is the summed-up value after breaking the addition weight of each particle by each specific gravity. Specific gravity is mentioned to "the chemistry goods of 13398" (Chemical Daily, 1998) etc. here with tin oxide (specific gravity 6.9), titanium oxide (specific gravity 3.8-4.2), cerium oxide (specific gravity 7.3), a zinc oxide (specific gravity 5.47-5.61), a zirconium dioxide (specific gravity 5.73), antimony oxide (specific gravity 5.2-5.4), etc. Since the conductivity of the ingredient after hardening will fall remarkably if the conductive whole particle product becomes less than the whole dielectric particle product, it is not desirable.

[0019] Moreover, the front face of a conductive particle and a dielectric particle can be embellished by various coupling agents etc. if needed. Organic acids, such as metal alkoxides, such as a silicon compound by which the organic permutation was carried out if considered as various coupling agents, and aluminum, titanium, a zirconium, antimony, a fatty acid, and a phosphoric acid, the salt of those, etc. are mentioned. Moreover, lightfastness can be raised by covering the front face of a dielectric particle with oxidation silicon etc.

[0020] The spreading film can be made easy to be filled up with between particles at the time of hardening,

and to form with a binder, in this invention. A binder makes requirements 5 - 100 weight **** rare ***** to the conductive particle 100 weight section, and its 10 - 90 weight **** rare ***** is desirable. Under in 5 weight sections, the degree of hardness of the ingredient after hardening falls, and if the 100 weight sections are exceeded, conductivity will fall remarkably.

[0021] It is not limited especially if this object can be attained as an ingredient used for a binder, and the organic substance, an inorganic substance, and its mixture can be used. In order to raise especially a degree of hardness, it is desirable that the hardenability monomer hardened with activity energy lines, such as heat or ultraviolet rays, and an electron ray, for a short time is included.

[0022] As an example of the aforementioned hardenability monomer, silicon compounds, such as monofunctional or polyfunctional (meta) acrylic ester, and a tetra-ethoxy silane, are mentioned, for example. As polyfunctional (meta) acrylic ester, for example, a polyfunctional alcoholic derivative, polyethylene GURIKORUJI (meta) acrylate, polyurethane (meta) acrylate, etc. are mentioned. Moreover, you may have functional groups, such as a hydroxyl group and a phosphoric ester radical, in the structure. Although especially the refractive index of said binder is not limited, in order not to lower the refractive index of the hardened ingredient, it is desirable that it is the binder whose refractive index of the binder after hardening is 1.48 or more, and it is still more desirable that it is within the limits of 1.55 or more and 1.80 or less. Since the refractive index of the ingredient which the refractive index hardened less than by 1.48 becomes low, it is not desirable. The activity of the hardenability monomer from which the refractive index of the binder after hardening becomes 1.55 or more gives [as opposed to / especially / a raise in the refractive index of the hardened ingredient] effectiveness. Acquisition of the hardenability monomer to which the refractive index of the binder after hardening will exceed 1.80 on the other hand is not easy.

[0023] What is necessary is just to have the polymerization initiation ability by UV irradiation as said photopolymerization initiator. Specifically For example, 1-hydroxy cyclohexyl phenyl ketone, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, 2-methyl-1-[4-(methylthio) phenyl]-2-mol FERINO propane-1-ON, Acetophenone system initiators, such as 1-[4-(2-hydroxy ethoxy) phenyl]-2-hydroxy-2-methyl-1-propane-1-ON; A benzoin, Benzoin system initiators, such as 2 and 2-dimethoxy -1 and 2-benzyl-1-ON; A benzophenone, [4-(methyl phenylthio) phenyl] phenyl meta-non, a 4-hydroxy benzophenone, Thioxan ton system initiators, such as benzophenone system initiator; 2-chloro thioxan ton [, such as 4-phenylbenzo phenon, 3, 3', 4, and a 4'-tetrapod (tert-butyl peroxide carbonyl) benzophenone], 2, and 4-diethyl thioxan ton, etc. can be mentioned. It is desirable to use the initiator which has absorption in long wavelength comparatively especially. These can be used as independent or mixture. Moreover, the approach of using together the reaction accelerator of adding the third class amines, such as p-dimethylamino ethyl benzoate ester and p-dimethylamino isoamyl benzoate ester, depending on the class of polymerization initiator may be used. As for the blending ratio of coal of a polymerization initiator, it is desirable that it is 0.01 - 20 weight section to the hardenability component 100 weight section in a binder. Since the surface hardness after hardening falls when the blending ratio of coal of an initiator exceeds under the 0.01 weight section and 20 weight sections, it is not desirable.

[0024] In the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in the constituent for high refractive-index conductivity ingredients. Especially other components are not limited and additives, such as an inorganic bulking agent, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable that a photopolymerization initiator is included. Moreover, as long as it makes it dry after membrane formation in a wet coating method, the solvent of the amount of arbitration can be added.

[0025] By applying the constituent for high refractive-index conductivity ingredients of this invention to a transparence base material, a transparent conductive ingredient can be obtained by stiffening this further.

[0026] Although not limited especially as construction material of a transparence base material, glass,

polyethylene terephthalate (PET), a polycarbonate (PC), a polymethyl-methacrylate (PMMA) copolymer, triacetyl cellulose (TAC), polyolefine (PO), a polyamide (PA), a polyvinyl chloride (PVC), etc. can be mentioned preferably, for example. In light transmission, transparency here is 30% or more, and is 80% or more still more preferably 50% or more more preferably.

[0027] Although not limited especially as a configuration of a transparence base material, the thing of the shape of tabular or a film is mentioned, for example. A film-like thing is preferably mentioned from the point of productivity and transportability. As thickness of a film, a 10-500-micrometer thing is mentioned more preferably than the point of transparency and workability.

[0028] Especially the method of application of the constituent for high refractive-index conductivity ingredients of this invention to a transparence base material is not limited, but can take a well-known wet coating method. For example, the roll coat method, a spin coat method, a dip coating method, etc. are mentioned as a typical thing. In these, since the roll coat method can be formed continuously, it is more desirable than the point of productivity. Moreover, after forming a layer if needed, it can be made to harden with an exposure and heating of an activity energy line. The thickness of the transparence conductive layer which is the spreading film has desirable 0.05-20 micrometers. Since problems, such as lowering of transparency, will arise if it is difficult to acquire sufficient conductivity if thickness is set to less than 0.05 micrometers and it exceeds 20 micrometers, it is not desirable.

[0029] By this invention, the surface-electrical-resistance value of a transparence electrical conducting material can be set to 10¹²ohms or less, and it is 10¹⁰ohms or less still more preferably. Since the antistatic effectiveness becomes less enough when it exceeds 10¹² ohms, it is not desirable.

[0030] Moreover, a transparence conductive layer and one or more layers of layers which have other functions between transparence base materials may be formed. It is not limited especially as the formation approach of a layer with other functions, but a well-known approach can be taken. For example, the wet coating method of the dry coating methods, such as vacuum evaporation and a spatter, a roll coat, a spin coat, a spray coat, etc. is mentioned. The ingredient to be used is not limited, either and one or more kinds can be made to give functions, such as improvement in a degree of hardness, anti-dazzle ** Newton ring prevention, cutoff of the light of specific wavelength, improvement in adhesion, and color tone amendment, if needed.

[0031] Moreover, since the ingredient which stiffened the constituent for high refractive-index conductivity ingredients of this invention combines a high refractive index and conductivity, it can make high optical-character ability and an antistatic function give by using as a high refractive-index layer of a decrease reflector.

[0032] When using the constituent for high refractive-index conductivity ingredients of this invention as a high refractive-index layer of a decrease reflector, it is desirable that the refractive index of the layer after hardening is 1.65 or more, and it is desirable that it is further 1.65 or more and 2.50 or less. In the thing exceeding less than 1.65 and 2.50, since optical-character ability falls, it is not desirable.

[0033] A decrease reflector can be formed as structure of having a multilayer decrease reflecting layer containing the high refractive-index layer which hardens the constituent for high refractive-index conductivity ingredients, and is obtained on a transparence base material. For example, two-layer structure which becomes order from a low refractive-index layer and a high refractive-index layer from an outermost layer of drum; four layer systems which consist of a low refractive-index layer, a high refractive-index layer and the three-tiered structure; low refractive-index layer that consists of an inside refractive-index layer, a high refractive-index layer, an inside refractive-index layer, and a high refractive-index layer are mentioned. The thing of two-layer structure is preferably mentioned from the viewpoint of productivity, cost, and a decrease reflection effect.

[0034] Although the thickness of a decrease reflecting layer changes with configurations of the class of base material, a configuration, and a layer, the same thickness as light wavelength or the thickness not more than it is desirable per layer. For example, when the decrease reflector of two-layer expresses a decrease reflection

effect to the human light, the thickness of thickness (nm) ≤ 200 of $125/nH \leq$ high refractive-index layer/ nH and a low refractive-index layer is designed for the thickness of a high refractive-index layer as thickness (nm) ≤ 165 of $100/nL \leq$ low refractive-index layer/ nL . However, nH and nL are the refractive indexes of a high refractive-index layer and a low refractive-index layer, respectively. Moreover, the thing same as a transparency base material as the aforementioned transparent conductive ingredient can be used.

[0035] in order to form a decrease reflecting layer, as a refractive index of a low refractive-index layer, the layer formed is a low refractive index from the layer [directly under] of it – things are made into requirements and, as for the refractive index, it is desirable that it is in the range of 1.40-1.55. It is difficult to form a layer hard [it is difficult to acquire decrease reflection effect sufficient in wet coating when exceeding 1.55, and] enough when it is less than 1.40. Moreover, the refractive index is not limited that what is necessary is just a layer with a refractive index lower [an inside refractive-index layer] than the high refractive-index layer which carries out a laminating, and a refractive index higher than a low refractive-index layer.

[0036] In this invention, other decrease reflecting layers except the high refractive-index layer by the constituent for high refractive-index conductivity ingredients can use a well-known thing conventionally.

[0037] As an ingredient of said low refractive-index layer, inorganic substances and fluorine-containing organic compounds, such as oxidation silicon, a fluoride lanthanum, magnesium fluoride, and cerous fluoride, can be used as independent or mixture. Moreover, a non-fluorine system monomer and a polymer can be used as a binder.

[0038] Although especially the aforementioned fluorine-containing organic compound is not limited, monomers, such as fluorine-containing (meta) acrylic ester of many organic functions, fluorine-containing itaconic-acid ester, a fluorine-containing maleate, and a fluorine-containing silicon compound, those polymers, etc. are mentioned, for example. The thing of structure which has the polymerization nature machine of monofunctional and many organic functions as a monomer is mentioned, and fluorine-containing (meta) acrylic ester is more desirable than a reactant viewpoint. An acrylic (meta) means an acrylic and/or methacrylic one here. Especially polyfunctional fluorine-containing (meta) acrylic ester is more desirable than the point of a degree of hardness and a refractive index. The layer of a low refractive index and a high degree of hardness can be made to form by stiffening these fluorine-containing organic compound.

[0039] As the aforementioned monofunctional fluorine-containing (meta) acrylic ester, 1-(meta) AKURIRO yloxy-1-perfluoroalkyl methane, 1-(meta) AKURIRO yloxy-2-perfluoroalkyl ethane, etc. are mentioned, for example. As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 8 and branching and an annular thing are mentioned.

[0040] As the aforementioned polyfunctional fluorine-containing (meta) acrylic ester, the fluorine-containing (meta) acrylic ester of two organic functions thru/or four organic functions is mentioned preferably. the – inside – two – organic functions – fluorine-containing (meta) – acrylic ester – ***** – for example – one – two – JI – (meth)acryloyloxy – three – perfluoroalkyl – butane – two – hydroxy one – one – H – one – H – two – H – three – H – three – H – perfluoroalkyl – two – ' – two – ' – a screw – {(meta) – acryloyl – oxymethyl –} – propionate – alpha – omega – JI (meta) – acryloyl – oxymethyl – perfluoro – an alkane – etc. – desirable – it can mention . As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 11 and branching and an annular thing are mentioned, and, as for ***** and a perfluoro alkane radical, a straight chain-like thing is mentioned preferably. These JI (meta) acrylic ester can be used as independent or mixture on the occasion of an activity.

[0041] As fluorine-containing polyfunctional (meta) acrylic ester other than the further aforementioned 2 organic functions, the fluorine-containing polyfunctional (meta) acrylic ester of three organic functions and four organic functions is mentioned. this – three – organic functions – fluorine-containing – polyfunctional (meta) – acrylic ester – an example – ***** – for example – two – (meth)acryloyloxy – one – H – one – H – two – H – three – H – three – H – perfluoroalkyl – two – ' – two – ' – a screw – {(meta) – acryloyl – oxymethyl –} – propionate – etc. – mentioning – having . As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 11 and branching and an annular thing are mentioned preferably.

[0042] Moreover, as an example of the fluorine-containing polyfunctional (meta) acrylic ester of four organic functions, they are alpha, beta, gamma, and omega-tetra-(meth)acryloyloxy. - An alphaH, alphaH, betaH, gammaH, gammaH, xH, xH and yH, omegaH, and omegaH-perfluoro alkane etc. can be mentioned preferably. As for a perfluoro alkane radical, the thing of the shape of a carbon number 1 thru/or a straight chain of 14 is mentioned preferably. On the occasion of an activity, the aforementioned fluorine-containing polyfunctional (meta) acrylic ester can be used as independent or mixture.

[0043] As a concrete example of the aforementioned fluorine-containing silicon compound, trimethoxysilane (1H, 1H, 2H, 2H-perfluoroalkyl) etc. can be mentioned preferably. As for a perfluoroalkyl radical, the shape of the shape of a carbon number 1 thru/or a straight chain of 10 and branching and an annular thing are mentioned preferably.

[0044] As a polymer of the aforementioned fluorine-containing organic compound, a straight chain-like polymers [, such as a homopolymer of the aforementioned monofunctional fluorine-containing monomer, a copolymer, or a copolymer with the monomer which does not contain a fluorine,], polymer [which includes a ring and heterocycle in a chain], annular polymer, and tandem-type polymer etc. is mentioned.

[0045] As the aforementioned non-fluorine system monomer, a well-known thing can be used conventionally. For example, silicon compounds, such as acrylic ester (meta) of monofunctional or many organic functions and a tetra-ethoxy silane, etc. are mentioned.

[0046] Moreover, in the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in decrease reflecting layers, such as a low refractive-index layer. Especially other components are not limited and additives, such as an inorganic bulking agent, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable to use a photopolymerization initiator. Moreover, as long as it makes it dry after membrane formation in a wet coating method, the solvent of the amount of arbitration can be added.

[0047] After applying and forming membranes to a base material with a wet coating method, decrease reflecting layers, such as a high refractive-index layer by the constituent for high refractive-index conductivity ingredients and a low refractive-index layer using said compound, and an inside refractive-index layer, can perform a hardening reaction if needed with an exposure and heating of heat, ultraviolet rays, an electron ray, etc. of an activity energy line, and can form a layer. Moreover, in the case of the constituent containing a solvent, a solvent can be dried before performing a hardening reaction.

[0048] What is necessary is just to have the polymerization initiation ability by UV irradiation as said photopolymerization initiator. Specifically For example, 1-hydroxy cyclohexyl phenyl ketone, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, 2-methyl-1-[4-(methylthio) phenyl]-2-mol FERINO propane-1-ON, Acetophenone system initiators, such as 1-[4-(2-hydroxy ethoxy) phenyl]-2-hydroxy-2-methyl-1-propane-1-ON; A benzoin, Benzoin system initiators, such as 2 and 2-dimethoxy -1 and 2-bibenzyl-1-ON; A benzophenone, [4-(methyl phenylthio) phenyl] phenyl meta-non, a 4-hydroxy benzophenone, Thioxan ton system initiators, such as benzophenone system initiator; 2-chloro thioxan ton [, such as 4-phenylbenzo phenon, 3, 3', 4, and a 4'-tetrapod (tert-butyl peroxide carbonyl) benzophenone], 2, and 4-diethyl thioxan ton, etc. can be mentioned. These can be used as independent or mixture. Moreover, the approach of using together the reaction accelerator of adding the third class amines, such as p-dimethylamino ethyl benzoate ester and p-dimethylamino isoamyl benzoate ester, depending on the class of polymerization initiator may be used. As for the blending ratio of coal of a polymerization initiator, it is desirable that it is 0.01 - 20 weight section to the hardenability component 100 weight section of a decrease reflecting layer. Since the surface hardness after hardening falls when the blending ratio of coal of an initiator is under the 0.01 weight section, a refractive index rises when 20 weight sections are exceeded and polymerization hardening is carried out, and a desired decrease reflecting layer cannot be formed, it is not desirable.

[0049] Said spreading can use the method of application of wet coating usually used. Specifically, the roll coat method, a dip coating method, a spin coat method, etc. are mentioned. When mass-production nature is taken into consideration, the roll coat method is desirable. It applies so that the thickness after desiccation and hardening may turn into predetermined thickness by these approaches.

[0050] For example, the class of black light used when UV irradiation performs a hardening reaction will not be limited especially if generally used, for example, a low pressure mercury lamp, a high-pressure mercury-vapor lamp, an ultrahigh pressure mercury lamp, a metal halide lamp, a xenon lamp, etc. are mentioned. As conditions for UV irradiation, 10 or more mJs of quantity of radiation are desirable, and its 100 or more mJs are still more desirable. Since sufficient surface hardness is not obtained after polymerization hardening when there is less quantity of radiation than 10mJ(s), it is not desirable. Moreover, after polymerization hardening, postcure by UV irradiation may be performed once [further] or more. As for the oxygen density at the time of UV irradiation, it is desirable to hold down the time of polymerization hardening and postcure to 1000 ppm or less by blowing inert gas, such as nitrogen and an argon.

[0051] Even after forming layers, such as a low refractive-index layer, as a surface-electrical-resistance value of a decrease reflecting layer on the layer which consists of a conductive high refractive-index constituent, it is desirable that it is 1012ohms or less, and it is still more desirable that it is 1010ohms or less. Since the antistatic effectiveness becomes less enough when it exceeds 1012 ohms, it is not desirable.

[0052] Furthermore, an one or more-layer layer can be formed between a transparence base material and a decrease reflecting layer. This layer can use an inorganic substance, the organic substance, or such mixture. The thickness has desirable 0.005-30 micrometers, and especially the formation approach of a layer is not limited. Moreover, one or more kinds of functions, such as cutoff of the light of specific wavelength, such as improvement in a degree of hardness, anti-dazzle ** Newton ring prevention, an ultraviolet-rays region, and a near infrared ray region, improvement in the adhesion between layers, and color tone amendment, can be given to these layers. When carrying out a laminating more than two-layer, a function which is different in each may be given. Grant of each function can use a well-known approach. It is desirable to prepare the rebound ace court layer especially aiming at improvement in a degree of hardness.

[0053] For example, when preparing a rebound ace court layer, an inorganic material, organic materials, or such mixture can be used. As an organic material used, hardened materials, such as silicon compounds, such as many organic functions or monofunctional acrylic ester (meta), and a tetra-ethoxy silane, are mentioned, for example. It is more desirable than the viewpoint of coexistence of productivity and a degree of hardness that it is especially the polymerization hardened material of an ultraviolet-rays hardenability polyfunctional acrylate monomer constituent.

[0054] It is not limited especially as said ultraviolet-rays hardenability polyfunctional acrylate monomer constituent, and the component of remaining as it is or others can be added, and the thing which mixed one or more kinds of well-known ultraviolet-rays hardenability polyfunctional acrylate monomers, or well-known ultraviolet-rays hardenability rebound ace court material can be used. As an ultraviolet-rays hardenability polyfunctional acrylate monomer Although not limited especially, for example Dipentaerythritol hexaacrylate, Tetramethylolmethane tetraacrylate, tetramethylolmethane triacrylate, Pentaerythritol pentaacrylate, trimethylolpropane triacrylate, Polyfunctional alcoholic derivatives, such as 1,6-hexanediol diacrylate, 1, and 6-screw (3-acryloyloxy-2-hydroxy propyloxy) hexane, polyethylene-glycol diacrylate, polyurethane acrylate, etc. are mentioned.

[0055] In the range which does not spoil the effectiveness of this invention other than the aforementioned compound, other components may be included in a rebound ace court layer. Especially other components are not limited and additives, such as inorganic or an organic bulking agent, inorganic or an organic particle, inorganic or an organic pigment, a polymer and a polymerization initiator, polymerization inhibitor, an anti-oxidant, a dispersant, a surface active agent, light stabilizer, an optical absorption agent, and a leveling agent, etc. are mentioned. When carrying out especially ultraviolet curing, it is desirable to use a photopolymerization initiator. Moreover, as long as it makes it dry after membrane formation in a wet coating

method, the solvent of the amount of arbitration can be added.

[0056] Moreover, especially the formation approach of a layer can be formed by the general wet coat methods, such as a roll coat and a die coat, when it is not limited but an organic material is used. The formed layer can perform a hardening reaction by the activity energy-line exposure of heating, an ultraviolet rays, an electron ray, etc., etc. if needed.

[0057] The aforementioned decrease reflector can be used for the application which needs a decrease reflection effect, high light transmission, and antistatic ability. It can use in order to suppress a surface echo of an electronic image display device especially. In using for these applications, it prepares a glue line in the field which does not form the decrease reflecting layer of a decrease reflector beforehand, and it sticks on an object and can use for it. Although not limited especially as an ingredient used for a glue line, an acrylic binder, ultraviolet curing mold adhesives, heat-curing mold adhesives, etc. can be mentioned, for example. Moreover, one or more kinds of functions, such as cutoff of the light of specific wavelength, improvement in contrast, and color tone amendment, can be given to this glue line.

[0058] As the aforementioned electronic image display device, the Braun tube, a plasma display (PDP), a liquid crystal display, etc. can be mentioned, for example. It can be made to be able to stick through a glue line and can use so that the field which does not form the decrease reflecting layer of a decrease reflector may touch the transparent material arranged in direct or a front face to this front face.

EXAMPLE

[Example] Hereafter, based on an example, it explains to a detail further.

As an example 1 conductivity particle, 0.05 micrometers of mean diameters, a refractive index 2.0, the indium oxide tin particle of specific gravity 6.5 it abbreviates to an ITO particle hereafter – As the 10 % of the weight ethanol dispersion-liquid 70 weight section and a dielectric particle, the mean particle diameter of 0.07 micrometers, A refractive index 2.3, the 10-% of the weight isopropanol (IPA) dispersion-liquid 30 weight section of the cerium oxide particle of specific gravity 7.3, The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tibia special tee KEMIKARUZU) 0.1 weight section were mixed as a binder, and Constituent A (the constituent A for high refractive-index conductivity ingredients) was produced.

[0060] The thickness of a layer was adjusted and applied so that the wavelength of the light which shows $\lambda/4$ for the obtained constituent A by desiccation thickness by the dip coater (Japan cedar Yamamoto physicochemistry device incorporated company make) on the acrylic board (a trade name "DERAGURASUA", Asahi Chemical Industry Co., Ltd. make) of 2mm in thickness and a refractive index 1.49 might be set to about 550nm. It hardened by irradiating [at 90 degrees C / for 1 minute] the ultraviolet rays of 400mJ after desiccation using 120W high-pressure mercury-vapor lamp under nitrogen-gas-atmosphere mind with a black light (Iwasaki Electric Co., Ltd. make), and the transparent conductive ingredient A was produced.

[0061] The refractive index after hardening of a constituent, the refractive index after hardening of a binder, and the surface-electrical-resistance value were measured by the following approaches, and the result was shown in a table 1. The refractive index after hardening of a constituent: 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face of a transparent conductive ingredient with the sandpaper, and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). According to the following formulas 1, the refractive index was calculated from the maximum reflectance R_{max} read in the reflectance spectrum.

[0062]

[Equation 1]

$$R_{\max}(\%) = \left\{ \frac{1.49 - (\text{組成物の硬化後の屈折率})^2}{1.49 + (\text{組成物の硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式1)$$

[0063] The refractive index after hardening of a binder: The sample which applied the constituent except a conductive particle and a dielectric particle to the PET film (a trade name "A4100", Toyobo Co., Ltd. make) of 188 micrometers in thickness and a refractive index 1.64, and was hardened was created. 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face with the sandpaper and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). According to the following formulas 2, the refractive index was calculated from the minimum reflection factor Rmin read in the reflectance spectrum.

[0064]

[Equation 2]

$$R_{\min}(\%) = \left\{ \frac{1.64 - (\text{バインダーの硬化後の屈折率})^2}{1.64 + (\text{バインダーの硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式2)$$

[0065] Surface-electrical-resistance value: The surface-electrical-resistance value of a transparent conductive ingredient was measured with the surface-electrical-resistance plan ("DSM8103", Toa Electronics, Ltd. make).

[0066] Constituent B (the constituent B for high refractive-index conductivity ingredients) and the transparent conductive ingredient B were produced like the example 1 except having used the 10-% of the weight ethanol dispersion-liquid 30 weight section of the titanium oxide particle of 0.04 micrometers of mean diameters, a refractive index 2.5, and specific gravity 4.9 as an example 2 dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0067] Constituent C (the constituent C for high refractive-index conductivity ingredients) and the transparent conductive ingredient C were produced like the example 1 except having used the 10-% of the weight toluene dispersion liquid of the antimony oxide tin particle (it abbreviates to an ATO particle hereafter.) of 0.05 micrometers of mean diameters, a refractive index 2.1, and specific gravity 5.2 as an example 3 conductivity particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0068] Constituent D (the constituent D for high refractive-index conductivity ingredients) and the transparent conductive ingredient D were produced like the example 1 except having used the 10-% of the weight IPA dispersion liquid of the tin oxide particle of the mean particle diameter of 0.03 micrometers, a refractive index 2.0, and specific gravity 6.9 as an example 4 conductivity particle, and having used the 10-% of the weight ethanol dispersion liquid of the zinc-oxide particle of the mean particle diameter of 0.04 micrometers, a refractive index 2.1, and specific gravity 5.5 as a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0069] Constituent E (the constituent E for high refractive-index conductivity ingredients) and the transparent conductive ingredient E were produced for DESORAITO Z9001 (product made from JSR, Inc.) of a refractive index 1.59 like the example 1 as example 5 binder except **** for 2 weight sections. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0070] Constituent F (the constituent F for high refractive-index conductivity ingredients) and the transparent conductive ingredient F were produced like the example 1 except having used the 10-% of the weight IPA dispersion-liquid 40 weight section of a cerium oxide particle as an example 6 conductivity particle as the 10-% of the weight ethanol dispersion-liquid 60 weight section of an ITO particle, and a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained

constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0071] The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tiba special tee KEMIKARUZU) 0.1 weight section were mixed as the 10-% of the weight ethanol dispersion-liquid 100 weight section of the ITO particle of 0.05 micrometers of example of comparison 1 mean diameters, and a binder, and Constituent G (the constituent G for conductive ingredients) and the transparent conductive ingredient G were produced. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0072] The tetramethylolmethane triacrylate 2 weight section and the photopolymerization initiator (product made from trade name "IRGACURE 907" tiba special tee KEMIKARUZU) 0.1 weight section were mixed as the 10-% of the weight isopropanol dispersion-liquid 100 weight section of the cerium oxide particle of 20.07 micrometers of examples of a comparison, and a binder, and Constituent H and the transparent material H were produced. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0073] Constituent I and the transparent material I were produced like the example 1 except having used the 10-% of the weight IPA dispersion-liquid 70 weight section of a cerium oxide particle with a mean particle diameter of 0.07 micrometers as an example of comparison 3 conductivity particle as the 10-% of the weight ethanol dispersion-liquid 30 weight section of an ITO particle with a mean particle diameter of 0.05 micrometers, and a dielectric particle. The refractive index and surface-electrical-resistance value after hardening of a binder and the obtained constituent were measured by the same approach as an example 1, and the result was shown in a table 1.

[0074]

[A table 1]

表1

	実施例						比較例		
	1	2	3	4	5	6	1	2	3
組成物の種類	A	B	C	D	E	F	G	H	I
導電性微粒子の種類	ITO	ITO	ATO	酸化錫	ITO	ITO	ITO	—	ITO
導電性微粒子の屈折率	2.0	2.0	2.1	2.0	2.0	2.0	2.0	—	2.0
誘電性微粒子の種類	酸化セリウム	酸化チタン	酸化チタン	酸化亜鉛	酸化セリウム	酸化セリウム	—	酸化セリウム	酸化セリウム
誘電性微粒子の屈折率	2.3	2.5	2.5	2.1	2.3	2.3	—	2.3	2.3
導電性微粒子重量 /誘電性微粒子重量	100/42.9	100/42.9	100/42.9	100/42.9	100/42.9	100/66.7	100/0	0/100	100/150
導電性微粒子の総体積 /誘電性微粒子の総体積	2.5	1.4	1.5	1.9	2.5	1.8	—	—	0.7
バインダーの硬化後の屈折率	1.51	1.51	1.51	1.51	1.59	1.51	1.51	1.51	1.51
組成物の硬化後の屈折率	1.68	1.70	1.71	1.66	1.71	1.73	1.62	1.77	1.74
表面抵抗値(Ω)	2.5×10^9	8.3×10^9	2.0×10^{10}	8.0×10^{11}	6.5×10^9	3.3×10^{10}	1.1×10^9	4.5×10^{14}	2.5×10^{13}

[0075] A refractive index becomes 1.65 or more and the hardened material of the constituent in an example 1 thru/or an example 6 is a high refractive index. Moreover, the surface-electrical-resistance value is in the range of 109-1012ohm, and shows sufficient surface-electrical-resistance value for electrification prevention. To it, in the example 1 of a comparison, a refractive index is as low as 1.61, and 1014 ohms and the antistatic effectiveness are not acquired for the surface-electrical-resistance value in the example 2 of a comparison. In the example 3 of a comparison, although a refractive index is high, the antistatic effectiveness is not fully acquired.

[0076] The example 1 (low refractive-index layer coating liquid for decrease reflectors) of manufacture 1, 2, 9, 10-tetra-acryloyloxy - 4, 4, 5, 5, 6, 6, 7, and 7-octafluoro decane 50 weight section, The 30% dispersion-liquid (trade name "XBA-ST" Nissan chemistry incorporated company make) 120 weight section of silica gel particles, 2', 2'-screw (meta) (acryloyl oxymethyl) propionic acid (2-hydroxy) - 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, 10, 11, 11, and 11-nonadeca fluoro undecyl, Ten weight sections, the butyl alcohol 900 weight section, and the photopolymerization initiator (trade name "KAYACURE BMS", Nippon Kayaku Co., Ltd. make) 5 weight section were mixed, and the low refractive-index layer coating liquid for decrease reflectors was prepared.

[0077] The example 2 (rebound ace court layer coating liquid for decrease reflectors) of manufacture The dipentaerythritol hexaacrylate 70 weight section, the thoria krill acid tetramethylolmethanes 20 and 1, the 6-screw (3-acryloyloxy-2-hydroxy propyloxy) hexane 30 weight section, the photopolymerization initiator (product made from trade name "IRGACURE 184" tiba special tee KEMIKARUZU) 4 weight section, and the IPA100 weight section were mixed, and the rebound ace court layer coating liquid for decrease reflectors (HC-1) was prepared.

[0078] On the PET film (a trade name "A4100", Toyobo Co., Ltd. make) whose example 7 thickness is 188 micrometers, the rebound ace court layer coating liquid for decrease reflectors (HC-1) prepared in the example 2 of manufacture was applied so that it might become about 4 micrometers of desiccation thickness by the bar coating machine, and it hardened by irradiating the ultraviolet rays of 400mJ(s) using a black light (the Iwasaki Electric Co., Ltd. make, 120W high-pressure mercury-vapor lamp), and the rebound ace court processing PET film was produced.

[0079] It hardened by adjusting the thickness of a layer and irradiating the ultraviolet rays of 400mJ after spreading using a black light (it being 120W high-pressure mercury-vapor lamp under the Iwasaki Electric Co., Ltd. make and nitrogen-gas-atmosphere mind) so that the wavelength of the light which shows $\lambda/4$ by desiccation thickness may be set to about 550nm in the constituent A moreover prepared in the example 1 by the dip coater (Japan cedar Yamamoto physicochemistry device incorporated company make). The decrease reflector was produced, when it applied and desiccation thickness hardened it similarly on it, respectively, after adjusting the low refractive-index layer coating liquid for decrease reflectors prepared in the example 1 of manufacture, as 550nm shows the minimum reflection factor.

[0080] The minimum reflection factor and surface-electrical-resistance value of a decrease reflector which were acquired were measured as follows. The result was shown in a table 2, respectively.

The minimum reflection factor: 400-700nm 5 degrees and -5-degree regular-reflection spectrum were measured for what damaged the rear face of a conductive decrease reflector with the sandpaper, and was smeared away in the black coatings with the spectrophotometer ("U-best 50", Jasco Corp. make). And the minimal value of a reflection factor was read in the reflectance spectrum, and it considered as the minimum reflection factor.

Surface-electrical-resistance value: It measured with the surface-electrical-resistance meter ("DSM8103", Toa Electronics, Ltd. make).

[0081] The decrease reflector was produced like the example 7 except having replaced with the example 8 - the 12 constituent A, and having used the constituent (B, C, D, E, F), respectively. Moreover, measurement of the minimum reflection factor of a decrease reflector and a surface-electrical-resistance value was performed like the example 7. The result was shown in a table 2, respectively.

[0082] The decrease reflector was produced like the example 7 except having replaced with the example 4 of a comparison - the 6 constituent A, and having used the constituent (G, H, I), respectively. Moreover, measurement of the minimum reflection factor of a decrease reflector and a surface-electrical-resistance value was performed like the example 7. The result was shown in a table 2, respectively.

[0083]

[A table 2]

表2

	実施例						比較例		
	7	8	9	10	11	12	4	5	6
組成物の種類	A	B	C	D	E	F	G	H	I
組成物の硬化後の屈折率	1.68	1.70	1.71	1.66	1.71	1.73	1.62	1.77	1.74
最小反射率(%)	0.9	0.7	0.6	1.0	0.6	0.4	1.3	0.3	0.4
表面抵抗値(Ω)	3.5×10^9	7.6×10^9	1.5×10^{10}	6.5×10^{11}	8.0×10^9	4.0×10^{10}	0.8×10^9	4.4×10^{13}	3.8×10^{12}

[0084] In an example 7 thru/or an example 12, the manufactured decrease reflector has the 1% or less of the minimum reflection factors, and an antistatic function. To it, in the example 4 of a comparison, a reflection factor is high, and antistatic ability comes out enough and it turns out by the examples 5 and 6 of a comparison that there is nothing.

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(54) 【発明の名称】 高屈折率導電性材料用組成物、透明導電性材料ならびに減反射材

(57) 【要約】

【課題】 帯電防止に優れ、かつ高屈折率な膜を形成することが可能な高屈折率導電性材料用組成物、およびそれを用いた透明導電性材料ならびに減反射材を提供する。

【解決手段】 導電性微粒子 (A成分)、屈折率2.0以上の誘電体微粒子 (B成分)、およびバインダー (C成分) からなる高屈折率導電性材料用組成物において、A成分100重量部に対して、B成分5~100重量部、C成分5~100重量部であることを特徴とする高屈折率導電性材料用組成物である。

【特許請求の範囲】

【請求項1】 導電性微粒子（A成分）、屈折率2.0以上の誘電体微粒子（B成分）、およびバインダー（C成分）からなる高屈折率導電性材料用組成物において、A成分100重量部に対して、B成分5～100重量部、C成分5～100重量部であることを特徴とする高屈折率導電性材料用組成物。

【請求項2】 導電性微粒子が酸化インジウム錫、酸化錫、酸化アンチモン錫、および酸化亜鉛アルミニウムからなる群より選ばれる少なくとも1種類である請求項1に記載の高屈折率導電性材料用組成物。

【請求項3】 誘電体微粒子が酸化チタン、酸化セリウム、および酸化亜鉛からなる群より選ばれる少なくとも1種類である請求項1または請求項2に記載の高屈折率導電性材料用組成物。

【請求項4】 導電性微粒子の占有する総体積が誘電体微粒子の占有する総体積以上である請求項1ないし請求項3のいずれか1つに記載の高屈折率導電性材料用組成物。

【請求項5】 バインダーが、硬化性単量体を含むバインダーである請求項1ないし請求項4のいずれか1つに記載の高屈折率導電性材料用組成物。

【請求項6】 バインダーが、硬化後の屈折率が1.55以上であるバインダーである請求項1ないし請求項5のいずれか1つに記載の高屈折率導電性材料用組成物。

【請求項7】 硬化後の高屈折率導電性材料組成物の屈折率が1.65以上である請求項1ないし請求項6のいずれか1つに記載の高屈折率導電性材料用組成物。

【請求項8】 請求項1ないし請求項7のいずれか1つに記載の高屈折率導電性材料用組成物を透明基材に塗布した透明導電性材料。

【請求項9】 請求項1ないし請求項7のいずれか1つに記載の高屈折率導電性材料用組成物を透明基材に塗布し、硬化させてなる透明導電性材料。

【請求項10】 請求項1ないし請求項7のいずれか1つに記載の高屈折率導電性組成物の硬化物を減反射層中に用いた減反射材。

【請求項11】 減反射層の表面抵抗値が $10^{12}\Omega$ 以下である請求項10に記載の減反射材。

【発明の詳細な説明】**【0001】**

【発明の属する技術分野】 帯電防止に優れ、かつ高屈折率な膜を形成することが可能な高屈折率導電性材料用組成物、およびそれを用いた透明導電性材料ならびに減反射材に関する。

【0002】

【従来の技術】 透明基板の最外層に、基板よりも低屈折率の物質からなる低屈折率層を可視光波長の $1/4$ の膜厚（約100nm）で形成すると、干渉効果により表面反射が低減し、透過率が向上することが知られている。

【0003】 最近では電気製品や光学製品、建材等の透明基板部分における表面反射の低減が強く求められる分野において、低屈折率層と透明基板との間に屈折率の異なる層を1層以上設けることにより表面反射を抑える多層減反射材が実用化されている。この多層減反射材を構成する減反射層の中間層に配置される層には、金属酸化物などの屈折率の高い無機材料が用いられている。

【0004】 減反射層の形成方法としては、フッ化マグネシウム等を蒸着後、スパッタリングする、いわゆるドライコーティング法（特開昭63-261646号公報）や、均一溶液ないし分散液の状態で基材に塗布後、乾燥、必要に応じて硬化させるウェットコーティング法（特開平7-48543号公報、特開平9-314038号公報）の2方法が主に知られている。これらのうち前者のドライコーティング法は高真空の大型設備が必要で、生産性が低いなどの問題があった。一方、後者のウェットコーティング法は設備投資が少なく、また生産性および大面積化への対応の点で優れている。

【0005】 利点の多いウェットコーティング法においても、一旦塗布工程を経る関係上、最終的に得られる高屈折率の層中には、無機材料の微粒子以外にバインダーに起因する成分が含まれる。そのためドライコーティングで同じ無機物を用いる場合に比べ屈折率が低くなる問題があった。

【0006】 また、減反射材を電気製品や光学製品に用いる際には、静電気による表面への埃の付着を抑えるため、帯電防止機能の付与が求められている。この帯電防止機能の発現には、表面抵抗値が $10^{12}\Omega$ 以下となる程度の導電性が必要である。

【0007】 しかしながら、酸化インジウム錫、酸化アンチモン錫、酸化錫や五酸化アンチモン酸亜鉛などの金属酸化物は、高い導電性を有する（特開平5-290634号公報、特開平11-314918号公報等）が、屈折率が低いという欠点を有している。それに対して、誘電体として利用される酸化チタン、酸化セリウムや酸化亜鉛などの金属酸化物は、屈折率は一般に高いが、導電性が低いという欠点を有している。このように両方の性質を兼ね備えた金属酸化物は存在しないため、ウェットコーティングで導電性を有し、かつ十分に高屈折率である層を形成することは困難とされていた。

【0008】

【発明が解決しようとする課題】 本発明の目的は、帯電防止に優れ、かつ高屈折率な膜を形成することが可能な高屈折率導電性材料用組成物、およびそれを用いた透明導電性材料ならびに減反射材を提供することにある。

【0009】

【課題を解決するための手段】 本発明者らは、前記問題点に鑑み鋭意検討した結果、導電性微粒子、誘電体微粒子、バインダーを特定割合で含んでなる高屈折率導電性組成物を用いることにより、本発明の課題を解決できる

ことを見出し、本発明を完成した。

【0010】即ち、第1の発明は、導電性微粒子（A成分）、屈折率2.0以上の誘電体微粒子（B成分）、およびバインダー（C成分）からなる高屈折率導電性材料用組成物において、A成分100重量部に対して、B成分5～100重量部、C成分5～100重量部であることを特徴とする高屈折率導電性材料用組成物である。第2の発明は、導電性微粒子が酸化インジウム錫、酸化錫、酸化アンチモン錫、および酸化亜鉛アルミニウムからなる群より選ばれる少なくとも1種類である第1の発明の高屈折率導電性材料用組成物である。第3の発明は、誘電体微粒子が酸化チタン、酸化セリウム、および酸化亜鉛からなる群より選ばれる少なくとも1種類である第1の発明または第2の発明の高屈折率導電性材料用組成物である。第4の発明は、導電性微粒子の占有する総体積が誘電体微粒子の占有する総体積以上である第1の発明ないし第3の発明のいずれか1つの高屈折率導電性材料用組成物である。

【0011】第5の発明は、バインダーが硬化性単量体を含むバインダーである第1の発明ないし第4のいずれか1つの高屈折率導電性材料用組成物である。第6の発明は、バインダーが、硬化後の屈折率が1.55以上であるバインダーである第1の発明ないし第5の発明のいずれか1つの高屈折率導電性材料用組成物である。第7の発明は、硬化後の高屈折率導電性材料用組成物の屈折率が1.65以上である第1の発明ないし第6の発明のいずれか1つの高屈折率導電性材料用組成物である。第8の発明は、第1の発明ないし第7の発明のいずれか1つの高屈折率導電性材料用組成物を透明基材に塗布した透明導電性材料である。第9の発明は、第1の発明ないし第7の発明のいずれか1つの高屈折率導電性材料用組成物を透明基材に塗布し、硬化させてなる透明導電性材料である。

【0012】第10の発明は、第1の発明ないし第7の発明のいずれか1つの高屈折率導電性材料用組成物の硬化物を減反射層中に用いた減反射材である。第11の発明は、減反射層の表面抵抗値が $10^{12}\Omega$ 以下であることを特徴とする第10の発明の減反射材である。

【0013】

【発明の実施の形態】本発明の高屈折率導電性材料用組成物は、導電性微粒子、屈折率2.0以上の誘電体微粒子、およびバインダーからなる組成物である。本発明において、導電性微粒子によって硬化後の材料に高い導電性を付与することができる。本発明に用いる導電性微粒子は目的を達成できれば特に限定されるものではなく、公知のもの全てを用いることができる。例えば、酸化錫（屈折率2.0）、リンダー酸化錫（屈折率2.0）、酸化インジウム錫（屈折率2.0）、酸化アンチモン錫（屈折率2.1）、酸化亜鉛アルミニウム（屈折率2.1）、酸化亜鉛アルミニウム（屈折率2.1）、

五酸化アンチモン—酸化亜鉛（屈折率2.0）などの金属酸化物が挙げられる。高い導電性を得るためには、酸化錫、酸化インジウム錫、酸化アンチモン錫、酸化亜鉛アルミニウムが好ましく挙げられる。

【0014】導電性微粒子の屈折率は1.8以上であることが好ましく、1.9以上であることがさらに好ましく、3.0以下である。屈折率1.8未満では硬化後の材料の屈折率が十分高くすることが難しい。3.0を超える導電性物質の微粒子化は困難となる傾向にあり、入手が容易ではなくなる。

【0015】本発明において、誘電体微粒子によって硬化後の材料に高い屈折率を付与することができる。本発明に用いる誘電体微粒子の屈折率は2.0以上であることを要件とし、好ましくは2.1以上、3.0以下である。屈折率が2.0未満では組成物の屈折率が十分高くすることが難しく、3.0を超える誘電体は微粒子化が困難となる傾向にある。例えば、酸化チタン（屈折率2.4～2.7）、酸化セリウム（屈折率2.3）、酸化亜鉛（屈折率2.1）、酸化ジルコニウム（屈折率2.1）、酸化アンチモン（屈折率2.1）、酸化インジウム（屈折率2.0）などが挙げられる。好ましくは、酸化チタン、酸化セリウム、酸化亜鉛が挙げられる。

【0016】前記の導電性微粒子および誘電体微粒子の平均粒径は可視光波長以下であることが好ましい。可視光波長を超えると組成物を塗布したときに透明性が著しく低下するため好ましくない。特に好ましくは $0.2\mu\text{m}$ 以下、さらに好ましくは $0.1\mu\text{m}$ 以下である。

【0017】前記の誘電体微粒子は導電性微粒子100重量部に対して5～100重量部の割合で組成物中に含まれることが必要であり、好ましくは10～80重量部、さらに好ましくは10～70重量部である。5重量部未満であると硬化後の材料の屈折率が十分でなく、また100重量部を超えると導電性が著しく低下するため好ましくない。

【0018】本発明の高屈折率導電性材料用組成物において、導電性微粒子の占有する総体積は、誘電体微粒子の占有する総体積以上であることが好ましい。この場合の総体積とは各微粒子の添加重量を各々の比重で割った後、総計した値である。ここで比重は、例えば「13398の化学商品」（化学工業日報社、1998年）等に酸化錫（比重6.9）、酸化チタン（比重3.8～4.2）、酸化セリウム（比重7.3）、酸化亜鉛（比重5.47～5.61）、酸化ジルコニウム（比重5.73）、酸化アンチモン（比重5.2～5.4）等と挙げられている。導電性微粒子の総体積が誘電体微粒子の総体積より少なくなると硬化後の材料の導電性が著しく低下するため好ましくない。

【0019】また必要に応じて導電性微粒子ならびに誘電体微粒子の表面を各種カップリング剤等により修飾す

ることができる。各種カップリング剤としては例えば、有機置換された珪素化合物や、アルミニウム、チタニウム、ジルコニウム、およびアンチモン等の金属アルコキシドや、脂肪酸やリン酸等の有機酸およびその塩等が挙げられる。また誘電体微粒子の表面を酸化珪素などで被覆することにより、耐光性を向上させることができる。

【0020】本発明において、バインダーによって、硬化時に微粒子間を充填し塗布膜を形成しやすくすることができる。バインダーは導電性微粒子100重量部に対して5～100重量部含まれることを要件とし、10～90重量部含まれることが好ましい。5重量部未満では硬化後の材料の硬度が低下し、100重量部を超えると導電性が著しく低下する。

【0021】バインダーに用いられる材料としては本目的を達成できれば特に限定されるものでなく、有機物、無機物およびその混合物を用いることができる。特に硬度を上げるために、熱もしくは紫外線や電子線などの活性エネルギー線により短時間に硬化する硬化性単量体を含むことが好ましい。

【0022】前記の硬化性単量体の具体例としては、例えば単官能もしくは多官能（メタ）アクリル酸エステル、テトラエトキシシラン等の珪素化合物が挙げられる。多官能（メタ）アクリル酸エステルとしては例えば多官能アルコール誘導体やポリエチレングリコールジ（メタ）アクリレート、ポリウレタン（メタ）アクリレートなどが挙げられる。またその構造中に水酸基やリン酸エステル基などの官能基を有していてもよい。前記バインダーの屈折率は特に限定されないが、硬化した材料の屈折率を下げないため、硬化後のバインダーの屈折率が1.48以上であるバインダーであることが好ましく、1.55以上、1.80以下の範囲内であることがさらに好ましい。屈折率が1.48未満では硬化した材料の屈折率が低くなるため好ましくない。硬化後のバインダーの屈折率が1.55以上となる硬化性単量体の使用は、硬化した材料の高屈折率化に対して特に効果を与える。一方、硬化後のバインダーの屈折率が1.80を越えることになる硬化性単量体の入手は容易ではない。

【0023】前記光重合開始剤としては、紫外線照射による重合開始能を有するものであれば良い。具体的には例えば、1-ヒドロキシシクロヘキシルフェニルケトン、2-ヒドロキシ-2-メチル-1-フェニルプロパン-1-オン、2-メチル-1-[4-(メチルチオ)フェニル]-2-モルフェリノプロパン-1-オン、1-[4-(2-ヒドロキシエトキシ)フェニル]-2-ヒドロキシ-2-メチル-1-プロパン-1-オン等のアセトフェノン系開始剤；ベンゾイン、2,2-ジメトキシ-1,2-ジフェニルエタン-1-オン等のベンゾイン系開始剤；ベンゾフェノン、[4-(メチルフェニルチオ)フェニル]フェニルメタノン、4-ヒドロキシベンゾフェノン、4-フェニルベンゾフェノン、3,

3', 4, 4'-テトラ（t-ブチルパーオキシカルボニル）ベンゾフェノン等のベンゾフェノン系開始剤；2-クロロチオキサントン、2,4-ジエチルチオキサントン等のチオキサントン系開始剤等を挙げることができる。特に比較的長波長に吸収を持つ開始剤を用いることが好ましい。これらは単独もしくは混合物として用いることができる。また、重合開始剤の種類によっては、p-ジメチルアミノ安息香酸エチルエステル、p-ジメチルアミノ安息香酸イソアミルエステル等の三級アミンを添加するなどの反応促進剤を併用する方法でもよい。重合開始剤の配合割合は、バインダー中の硬化性成分100重量部に対し、0.01～20重量部であることが好ましい。開始剤の配合割合が0.01重量部未満および20重量部を超える場合には硬化後の表面硬度が低下するので好ましくはない。

【0024】高屈折率導電性材料用組成物には前記の化合物以外に本発明の効果を損なわない範囲において、その他の成分を含んでも構わない。その他の成分とは特に限定されるものではなく、例えば、無機充填剤、無機もしくは有機顔料、重合体、および重合開始剤、重合禁止剤、酸化防止剤、分散剤、界面活性剤、光安定剤、光吸収剤、レベリング剤などの添加剤などが挙げられる。特に紫外線硬化させる場合には光重合開始剤を含むことが好ましい。またウェットコーティング法において成膜後乾燥させる限りにおいて、任意の量の溶媒を添加することができる。

【0025】本発明の高屈折率導電性材料用組成物を透明基材に塗布することにより、さらにこれを硬化させることにより、透明導電性材料を得ることができる。

【0026】透明基材の材質としては特に限定されるものではないが、例えばガラス、ポリエチレンテレフタレート（PET）、ポリカーボネート（PC）、ポリメタクリル酸メチル（PMMA）共重合体、トリアセチルセルロース（TAC）、ポリオレフィン（PO）、ポリアミド（PA）、ポリ塩化ビニル（PVC）等を好ましく挙げることができる。ここでいう透明性とは光線透過率で30%以上であり、より好ましくは50%以上、更に好ましくは80%以上である。

【0027】透明基材の形状としては特に限定されるものではないが、例えば板状もしくはフィルム状のものが挙げられる。生産性、運搬性の点からフィルム状のものが好ましく挙げられる。フィルムの厚みとしては10～500μmのものが透明性、作業性の点より好ましく挙げられる。

【0028】透明基材への本発明の高屈折率導電性材料用組成物の塗布方法は特に限定されず、公知のウェットコーティング法をとることができる。例えばロールコート法、スピンコート法、ディップコート法などが代表的なものとして挙げられる。これらの中でロールコート法は連続的に形成できるため生産性の点より好ましい。ま

た必要に応じて層を形成した後、活性エネルギー線の照射や加熱により硬化させることができる。塗布膜である透明導電層の厚みは $0.05 \sim 20 \mu\text{m}$ が好ましい。厚みが $0.05 \mu\text{m}$ 未満になると十分な導電性を得ることが難しく、 $20 \mu\text{m}$ を超えると透明性の低下などの問題が生じるため好ましくない。

【0029】本発明によって、透明導電材料の表面抵抗値を $10^{12} \Omega$ 以下とすることができ、さらに好ましくは $10^{10} \Omega$ 以下とすることができ、 $10^{12} \Omega$ を超えると帯電防止効果が十分でなくなるため好ましくない。

【0030】また透明導電層と透明基材の間にその他の機能を持つ層を1層以上形成してもよい。その他の機能を持つ層の形成方法としては特に限定されず、公知の方法をとることができる。例えば蒸着、スパッタなどのドライコーティング法、ロールコート、スピンコート、スプレーコートなどのウェットコーティング法が挙げられる。用いる材料も限定されず、また必要に応じて、硬度の向上、防眩、ニュートンリング防止、特定波長の光の遮断、密着性の向上、色調補正等の機能を1種類以上を付与させることができる。

【0031】また本発明の高屈折率導電性材料用組成物を硬化させた材料は高屈折率と導電性を兼ね備えているため、減反射材の高屈折率層として用いることにより、高い光学性能と帯電防止機能を付与させることができる。

【0032】本発明の高屈折率導電性材料用組成物を減反射材の高屈折率層として用いる場合には、硬化後の層の屈折率が 1.65 以上であることが好ましく、さらに 1.65 以上かつ 2.50 以下であることが好ましい。 1.65 未満ならびに 2.50 を超えるものでは、光学性能が低下するため好ましくない。

【0033】減反射材は、透明基材上に高屈折率導電性材料用組成物を硬化して得られる高屈折率層を含む多層の減反射層を有する構造として形成することができる。例えば最外層から順に低屈折率層および高屈折率層からなる2層構造；低屈折率層、高屈折率層、および中屈折率層からなる3層構造；低屈折率層、高屈折率層、中屈折率層、および高屈折率層からなる4層構造等が挙げられる。生産性、コスト、減反射効果の観点より、2層構造のものが好ましく挙げられる。

【0034】減反射層の厚みは基材の種類、形状、層の構成によって異なるが、1層あたり可視光波長と同じ厚みもしくはそれ以下の厚みが好ましい。例えば、2層減反射材によりヒトの可視光に減反射効果を現す場合は、高屈折率層の膜厚は $125 / n_H \leq$ 高屈折率層の厚さ

(nm) $\leq 200 / n_H$ 、及び低屈折率層の膜厚は、 $100 / n_L \leq$ 低屈折率層の厚さ(nm) $\leq 165 / n_L$ として設計される。ただし、 n_H 、 n_L はそれぞれ高屈折率層、低屈折率層の屈折率である。また透明基材としては前記の透明導電性材料と同様のものを用いることが

できる。

【0035】減反射層を形成するために、低屈折率層の屈折率としては、形成される層がその直下の層より低屈折率であることとを要件とし、その屈折率は $1.40 \sim 1.55$ の範囲にあることが好ましい。 1.55 を超える場合はウェットコーティングでは十分な減反射効果を得ることが難しく、また 1.40 未満の場合は十分に硬い層を形成することが困難である。また中屈折率層は積層する高屈折率層より屈折率が低く、低屈折率層より屈折率の高い層であればよく、その屈折率は限定されない。

【0036】本発明において、高屈折率導電性材料用組成物による高屈折率層を除いた他の減反射層は従来公知のものが使用できる。

【0037】前記低屈折率層の材料としては酸化珪素、フッ化ランタン、フッ化マグネシウム、フッ化セリウム等の無機物や含フッ素有機化合物を単独または混合物として用いることができる。また非フッ素系単量体や重合体をバインダーとして用いることができる。

【0038】前記の含フッ素有機化合物は特に限定されるものではないが、例えば多官能の含フッ素(メタ)アクリル酸エステル、含フッ素イタコン酸エステル、含フッ素マレイン酸エステル、含フッ素珪素化合物等の単量体、およびそれらの重合体等が挙げられる。単量体としては単官能および多官能の重合性基を有する構造のものが挙げられ、反応性の観点より含フッ素(メタ)アクリル酸エステルが好ましい。ここで(メタ)アクリルは、アクリルおよび/またはメタクリルを意味する。特に多官能含フッ素(メタ)アクリル酸エステルが硬度、屈折率の点より好ましい。これら含フッ素有機化合物を硬化させることにより、低屈折率かつ高硬度の層を形成させることができる。

【0039】前記の単官能含フッ素(メタ)アクリル酸エステルとしては、例えば1-(メタ)アクリロイロキシ-1-パーフルオロアルキルメタン、1-(メタ)アクリロイロキシ-2-パーフルオロアルキルエタン等が挙げられる。パーフルオロアルキル基は炭素数1ないし8の直鎖状、分枝状、環状のものが挙げられる。

【0040】前記の多官能含フッ素(メタ)アクリル酸エステルとしては、2官能ないし4官能の含フッ素(メタ)アクリル酸エステルが好ましく挙げられる。その中で2官能の含フッ素(メタ)アクリル酸エステルとしては、例えば、1,2-ジ(メタ)アクリロイルオキシ-3-パーフルオロアルキルブタン、2-ヒドロキシ-1H,1H,2H,3H,3H-パーフルオロアルキル-2',2'-ビス[(メタ)アクリロイルオキシメチル]プロピオナート、 α , ω -ジ(メタ)アクリロイルオキシメチルパーフルオロアルカン等を好ましく挙げる。パーフルオロアルキル基は炭素数1ないし11の直鎖状、分枝状、環状のものが考えられ、パーフ

ルオロアルカン基は直鎖状のものが好ましく挙げられる。これらのジ(メタ)アクリル酸エステルは、使用に際して単独もしくは混合物として用いることができる。

【0041】さらに前記の2官能以外の含フッ素多官能(メタ)アクリル酸エステルとしては、3官能および4官能の含フッ素多官能(メタ)アクリル酸エステルが挙げられる。該3官能の含フッ素多官能(メタ)アクリル酸エステルの例としては、例えば、2-(メタ)アクリロイルオキシ-1H, 1H, 2H, 3H, 3H-パーフルオロアルキル-2', 2'-ビス{(メタ)アクリロイルオキシメチル}プロピオナート等が挙げられる。パーフルオロアルカン基は炭素数1ないし11の直鎖状、分枝状、環状のものが好ましく挙げられる。

【0042】また、4官能の含フッ素多官能(メタ)アクリル酸エステルの例としては、 α , β , γ , ω -テトラ(メタ)アクリロイルオキシ- α H, α H, β H, γ H, γ H, x H, x H, y H, ω H, ω H-パーフルオロアルカン等を好ましく挙げる事ができる。パーフルオロアルカン基は炭素数1ないし14の直鎖状のものが好ましく挙げられる。使用に際しては、前記の含フッ素多官能(メタ)アクリル酸エステルは、単独もしくは混合物として用いることができる。

【0043】前記の含フッ素珪素化合物の具体的な例としては、(1H, 1H, 2H, 2H-パーフルオロアルキル)トリメトキシシラン等を好ましく挙げる事ができる。パーフルオロアルカン基は炭素数1ないし10の直鎖状、分枝状、環状のものが好ましく挙げられる。

【0044】前記の含フッ素有機化合物の重合体としては前記の単官能含フッ素単量体の単独重合体、共重合体、もしくはフッ素を含まない単量体との共重合体等の直鎖状重合体、鎖中に炭素環や複素環を含む重合体、環状重合体、櫛型重合体などが挙げられる。

【0045】前記の非フッ素系単量体としては、従来公知のものをを用いることができる。例えば単官能もしくは多官能の(メタ)アクリル酸エステルやテトラエトキシシラン等の珪素化合物等が挙げられる。

【0046】また低屈折率層等の減反射層には前記の化合物以外に本発明の効果を損なわない範囲において、その他の成分を含んでも構わない。その他の成分とは特に限定されるものではなく、例えば、無機充填剤、無機もしくは有機顔料、重合体、および重合開始剤、重合禁止剤、酸化防止剤、分散剤、界面活性剤、光安定剤、光吸収剤、レベリング剤などの添加剤などが挙げられる。特に紫外線硬化させる場合には光重合開始剤を用いることが好ましい。またウェットコーティング法において成膜後乾燥させる限りは、任意の量の溶媒を添加することができる。

【0047】高屈折率導電性材料用組成物による高屈折率層および前記化合物を用いた低屈折率層、中屈折率層等の減反射層はウェットコーティング法により基材に塗

布、成膜した後、必要に応じて熱や紫外線、電子線などの活性エネルギー線の照射や加熱により硬化反応を行って層を形成することができる。また溶媒を含む組成物の場合には、硬化反応を行う前に溶媒を乾燥させることができる。

【0048】前記光重合開始剤としては、紫外線照射による重合開始能を有するものであれば良い。具体的には例えば、1-ヒドロキシシクロヘキシルフェニルケトン、2-ヒドロキシ-2-メチル-1-フェニルプロパン-1-オン、2-メチル-1-[4-(メチルチオ)フェニル]-2-モルフェリノプロパン-1-オン、1-[4-(2-ヒドロキシエトキシ)フェニル]-2-ヒドロキシ-2-メチル-1-プロパン-1-オン等のアセトフェノン系開始剤；ベンゾイン、2,2-ジメトキシ-1,2-ジフェニルエタン-1-オン等のベンゾイン系開始剤；ベンゾフェノン、[4-(メチルフェニルチオ)フェニル]フェニルメタノン、4-ヒドロキシベンゾフェノン、4-フェニルベンゾフェノン、3,3',4,4'-テトラ(t-ブチルパーオキシカルボニル)ベンゾフェノン等のベンゾフェノン系開始剤；2-クロロチオキサントン、2,4-ジエチルチオキサントン等のチオキサントン系開始剤等を挙げる事ができる。これらは単独もしくは混合物として用いることができる。また、重合開始剤の種類によっては、p-ジメチルアミノ安息香酸エチルエステル、p-ジメチルアミノ安息香酸イソアミルエステル等の三級アミンを添加するなどの反応促進剤を併用する方法でも良い。重合開始剤の配合割合は、減反射層の硬化性成分100重量部に対し、0.01~20重量部であることが望ましい。開始剤の配合割合が0.01重量部未満の場合には硬化後の表面硬度が低下し、20重量部を超える場合には、重合硬化した際に屈折率が上昇し、所望の減反射層を形成できないので好ましくない。

【0049】前記塗布は通常用いられるウェットコーティングの塗布方法を用いることができる。具体的には例えば、ロールコート法、ディップコート法及びスピンコート法等が挙げられる。連続生産性を考慮すると、ロールコート法が好ましい。これらの方法により乾燥、硬化後の膜厚が所定の膜厚となるように塗布する。

【0050】例えば紫外線照射により硬化反応を行う場合に用いられる紫外線灯の種類は、一般的に用いられているものであれば特に限定されず、例えば、低圧水銀灯、高圧水銀灯、超高圧水銀灯、メタルハライドランプ、キセノンランプ等が挙げられる。紫外線照射の条件としては、照射線量は10mJ以上が好ましく、100mJ以上がさらに好ましい。照射線量が10mJより少ない場合には重合硬化後、十分な表面硬度が得られないので好ましくない。また重合硬化後に、紫外線照射による後硬化をさらに1回以上行っても良い。紫外線照射時の酸素濃度は、重合硬化時及び後硬化時とも、窒素、ア

ルゴンなどの不活性ガスを吹き込むことにより、100 ppm以下に抑えることが好ましい。

【0051】減反射層の表面抵抗値としては、低屈折率層などの層を導電性高屈折率組成物からなる層の上に形成した後も $10^{12}\Omega$ 以下であることが好ましく、 $10^{10}\Omega$ 以下であることがさらに好ましい。 $10^{12}\Omega$ を超えると帯電防止効果が十分でなくなるため好ましくない。

【0052】さらに、透明基材と減反射層の間に、1層以上の層を形成することができる。この層は無機物、有機物、もしくはこれらの混合物を用いることができる。その厚みは0.005～30 μm が好ましく、層の形成方法は特に限定されない。またこれらの層には硬度の向上、防眩、ニュートンリング防止、紫外線域や近赤外線域などの特定波長の光の遮断、層間の密着性の向上、色調補正等の機能を1種類以上付与することができる。2層以上積層する場合にはそれぞれに異なる機能を付与してもよい。それぞれの機能の付与は公知の方法を用いることができる。特に硬度の向上を目的としたハードコート層を設けるのが好ましい。

【0053】例えばハードコート層を設ける場合は、無機材料、有機材料、もしくはこれらの混合物を用いることができる。用いられる有機材料としては、例えば多官能もしくは単官能の(メタ)アクリル酸エステル、テトラエトキシシラン等の珪素化合物等の硬化物が挙げられる。生産性および硬度の両立の観点より、紫外線硬化性多官能アクリレート単量体組成物の重合硬化物であることが特に好ましい。

【0054】前記紫外線硬化性多官能アクリレート単量体組成物としては特に限定されるものでなく、例えば公知の紫外線硬化性多官能アクリレート単量体を1種類以上混合したもの、もしくは公知の紫外線硬化性ハードコート材をそのまま、もしくはその他の成分を添加して用いることができる。紫外線硬化性多官能アクリレート単量体としては、特に限定されるものではないが、例えばジペンタエリスリトールヘキサアクリレート、テトラメチロールメタントリアクリレート、テトラメチロールメタントリアクリレート、ペンタエリスリトールペンタアクリレート、トリメチロールプロパントリアクリレート、1,6-ヘキサジオールジアクリレート、1,6-ビス(3-アクリロイルオキシ-2-ヒドロキシプロピルオキシ)ヘキサン等の多官能アルコール誘導体やポリエチレングリコールジアクリレート、ポリウレタンアクリレートなどが挙げられる。

【0055】ハードコート層には前記の化合物以外に本発明の効果を損なわない範囲において、その他の成分を含んでも構わない。その他の成分とは特に限定されるものではなく、例えば、無機または有機充填剤、無機もしくは有機微粒子、無機または有機顔料、重合体、および重合開始剤、重合禁止剤、酸化防止剤、分散剤、界面活性剤、光安定剤、光吸収剤、レベリング剤などの添加剤

などが挙げられる。特に紫外線硬化させる場合には光重合開始剤を用いることが好ましい。またウェットコーティング法において成膜後乾燥させる限りは、任意の量の溶媒を添加することができる。

【0056】また層の形成方法は特に限定されず、有機材料を用いた場合には、ロールコートやダイコート等、一般的なウェットコート法により形成することができる。形成した層は必要に応じて加熱や紫外線、電子線などの活性エネルギー線照射により硬化反応を行うことができる。

【0057】前記の減反射材は減反射効果、高光線透過率および帯電防止能を必要とする用途に用いることができる。特に電子画像表示装置の表面反射を抑える目的で用いることができる。これらの用途に用いる場合には減反射材の減反射層を形成していない面にあらかじめ接着層を設け、対象物に貼り合せて用いることができる。接着層に用いられる材料としては特に限定されるものではないが、例えば、アクリル系粘着剤、紫外線硬化型接着剤、熱硬化型接着剤等を挙げることができる。また、この接着層には特定波長の光の遮断、コントラスト向上、色調補正等の機能を1種類以上付与することができる。

【0058】前記の電子画像表示装置としては、例えば、ブラウン管、プラズマディスプレイ(PDP)、液晶表示装置等を挙げることができる。該表面に直接、もしくは前面に配置する透明材料に減反射材の減反射層を形成していない面が接するように接着層を介して密着させて用いることができる。

【0059】

【実施例】以下、実施例に基き更に詳細に説明する。

実施例1

導電性微粒子として平均粒径0.05 μm 、屈折率2.0、比重6.5の酸化インジウム錫微粒子(以下、ITO微粒子と略す。)の10重量%エタノール分散液70重量部、誘電体微粒子として平均粒径0.07 μm 、屈折率2.3、比重7.3の酸化セリウム微粒子の10重量%イソプロパノール(IPA)分散液30重量部、バインダーとしてテトラメチロールメタントリアクリレート2重量部、光重合開始剤(商品名「IRGACURE 907」、チバスペシャルティケミカルズ製)0.1重量部を混合し、組成物A(高屈折率導電性材料用組成物A)を作製した。

【0060】得られた組成物Aを厚さ2mm、屈折率1.49のアクリル板(商品名「デラガラスA」、旭化成工業株式会社製)上に、ディップコーター(杉山元理化学機器株式会社製)により、乾燥膜厚で $\lambda/4$ を示す光の波長が550nm程度になるように層の厚さを調整して塗布した。90℃で1分間乾燥後、紫外線照射装置(岩崎電気株式会社製)により窒素雰囲気下で120W高圧水銀灯を用いて、400mJの紫外線を照射することにより硬化し、透明導電性材料Aを作製した。

【0061】組成物の硬化後の屈折率、バインダーの硬化後の屈折率および表面抵抗値を以下の方法で測定し、結果を表1に示した。組成物の硬化後の屈折率：透明導電性材料の裏面をサンドペーパーで荒らし、黒色塗料で塗りつぶしたものを分光光度計（「U-best 50」、日本分光株式会社製）により、400～700nm

mの5°、-5°正反射スペクトルを測定した。反射スペクトルから読み取った最大反射率Rmaxより以下の式1に従い屈折率を計算した。

【0062】

【数1】

$$R_{\max}(\%) = \left\{ \frac{1.49 - (\text{組成物の硬化後の屈折率})^2}{1.49 + (\text{組成物の硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式1)$$

【0063】バインダーの硬化後の屈折率：導電性微粒子および誘電体微粒子を除いた組成物を厚さ188μm、屈折率1.64のPETフィルム（商品名「A4100」、東洋紡績株式会社製）に塗布、硬化したサンプルを作成した。その裏面をサンドペーパーで荒らし、黒色塗料で塗りつぶしたものを分光光度計（「U-best

t 50」、日本分光株式会社製）により、400～700nmの5°、-5°正反射スペクトルを測定した。反射スペクトルから読み取った最小反射率Rminより以下の式2に従い屈折率を計算した。

【0064】

【数2】

$$R_{\min}(\%) = \left\{ \frac{1.64 - (\text{バインダーの硬化後の屈折率})^2}{1.64 + (\text{バインダーの硬化後の屈折率})^2} \right\}^2 \times 100 \dots\dots (式2)$$

【0065】表面抵抗値：透明導電性材料の表面抵抗値を、表面抵抗計（「DSM8103」、東亜電波工業株式会社製）で測定した。

【0066】実施例2

誘電体微粒子として平均粒径0.04μm、屈折率2.5、比重4.9の酸化チタン微粒子の10重量%エタノール分散液30重量部を用いた以外は実施例1と同様にして組成物B（高屈折率導電性材料用組成物B）、および透明導電性材料Bを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0067】実施例3

導電性微粒子として平均粒径0.05μm、屈折率2.1、比重5.2の酸化アンチモン錫微粒子（以下、ATO微粒子と略す。）の10重量%トルエン分散液を用いた以外は実施例1と同様にして、組成物C（高屈折率導電性材料用組成物C）、および透明導電性材料Cを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0068】実施例4

導電性微粒子として平均粒径0.03μm、屈折率2.0、比重6.9の酸化錫微粒子の10重量%IPA分散液を、誘電体微粒子として平均粒径0.04μm、屈折率2.1、比重5.5の酸化亜鉛微粒子の10重量%エタノール分散液を用いた以外は実施例1と同様にして、組成物D（高屈折率導電性材料用組成物D）、および透明導電性材料Dを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0069】実施例5

バインダーとして屈折率1.59のデソライトZ900

1（JSR株式会社製）を2重量部用いた以外は実施例1と同様にして、組成物E（高屈折率導電性材料用組成物E）、および透明導電性材料Eを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0070】実施例6

導電性微粒子としてITO微粒子の10重量%エタノール分散液60重量部、誘電体微粒子として酸化セリウム微粒子の10重量%IPA分散液40重量部を用いた以外は実施例1と同様にして、組成物F（高屈折率導電性材料用組成物F）、および透明導電性材料Fを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0071】比較例1

平均粒径0.05μmのITO微粒子の10重量%エタノール分散液100重量部、バインダーとしてテトラメチロールメタントリアクリレート2重量部、光重合開始剤（商品名「IRGACURE 907」、チバスペシャルティケミカルズ製）0.1重量部を混合し、組成物G（導電性材料用組成物G）、および透明導電性材料Gを作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0072】比較例2

0.07μmの酸化セリウム微粒子の10重量%イソプロパノール分散液100重量部、バインダーとしてテトラメチロールメタントリアクリレート2重量部、光重合開始剤（商品名「IRGACURE 907」、チバスペシャルティケミカルズ製）0.1重量部を混合し、組成物H、および透明材料Hを作製した。バインダーおよ

び得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0073】比較例3

導電性微粒子として平均粒径0.05 μm のITO微粒子の10重量%エタノール分散液30重量部、誘電体微粒子として平均粒径0.07 μm の酸化セリウム微粒子

の10重量%IPA分散液70重量部を用いた以外は実施例1と同様にして組成物1、および透明材料1を作製した。バインダーおよび得られた組成物の硬化後の屈折率、および表面抵抗値を実施例1と同様の方法で測定し、結果を表1に示した。

【0074】

【表1】

表1

	実施例						比較例		
	1	2	3	4	5	6	1	2	3
組成物の種類	A	B	C	D	E	F	G	H	I
導電性微粒子の種類	ITO	ITO	ATO	酸化錫	ITO	ITO	ITO	—	ITO
導電性微粒子の屈折率	2.0	2.0	2.1	2.0	2.0	2.0	2.0	—	2.0
誘電体微粒子の種類	酸化セリウム	酸化チタン	酸化チタン	酸化亜鉛	酸化セリウム	酸化セリウム	—	酸化セリウム	酸化セリウム
誘電体微粒子の屈折率	2.3	2.5	2.5	2.1	2.3	2.3	—	2.3	2.3
導電性微粒子重量 /誘電体微粒子重量	100/42.9	100/42.9	100/42.9	100/42.9	100/42.9	100/66.7	100/0	0/100	100/150
導電性微粒子の総体積 /誘電体微粒子の総体積	2.5	1.4	1.5	1.9	2.5	1.6	—	—	0.7
バインダーの硬化後の屈折率	1.51	1.51	1.51	1.51	1.59	1.51	1.51	1.51	1.51
組成物の硬化後の屈折率	1.68	1.70	1.71	1.66	1.71	1.73	1.62	1.77	1.74
表面抵抗値(Ω)	2.5×10^9	8.3×10^9	2.0×10^{10}	8.0×10^{11}	6.5×10^9	3.3×10^{10}	1.1×10^9	4.5×10^{14}	2.5×10^{13}

【0075】実施例1ないし実施例6における組成物の硬化物は、屈折率が1.65以上となり、高屈折率である。またその表面抵抗値は $10^9 \sim 10^{12} \Omega$ の範囲にあり、帯電防止に十分な表面抵抗値を示している。それに対し比較例1では屈折率が1.61と低く、また比較例2では表面抵抗値が $10^{14} \Omega$ と帯電防止効果が得られていない。比較例3では屈折率の高いものの帯電防止効果が十分に得られていない。

【0076】製造例1（減反射材用低屈折率層塗液）

1, 2, 9, 10-テトラアクリロイルオキシ-4, 4, 5, 5, 6, 6, 7, 7-オクタフルオロデカン50重量部、シリカゲル微粒子30%分散液（商品名「XBA-ST」、日産化学株式会社製）120重量部、2', 2'-ビス（（メタ）アクリロイルオキシメチル）プロピオン酸（2-ヒドロキシ）-4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, 10, 1

1, 11, 11-ノナデカフルオロウンデシル、10重量部、ブチルアルコール900重量部、光重合開始剤（商品名「KAYACURE BMS」、日本化薬株式会社製）5重量部を混合し減反射材用低屈折率層塗液を調製した。

【0077】製造例2（減反射材用ハードコート層塗液）

ジペンタエリスリトールヘキサアクリレート70重量部、トリアクリル酸テトラメチロールメタン20、1, 6-ビス（3-アクリロイルオキシ-2-ヒドロキシプロピルオキシ）ヘキサン30重量部、光重合開始剤（商品名「IRGACURE 184」、チバスペシャルティケミカルズ製）4重量部、IPA100重量部を混合し減反射材用ハードコート層塗液（HC-1）を調製した。

【0078】実施例7

厚みが188 μ mのPETフィルム（商品名「A4100」、東洋紡績株式会社製）上に、製造例2で調製した減反射材用ハードコート層塗液（HC-1）をバーコーターにより乾燥膜厚4 μ m程度になるように塗布し、紫外線照射装置（岩崎電気株式会社製、120W高圧水銀灯）を用いて400mJの紫外線を照射することにより硬化し、ハードコート処理PETフィルムを作製した。

【0079】その上に、ディップコーター（杉山元理化学機器株式会社製）により、実施例1にて調製した組成物Aを乾燥膜厚で $\lambda/4$ を示す光の波長が550nm程度になるように層の厚さを調整して塗布後、紫外線照射装置（岩崎電気株式会社製、窒素雰囲気下で120W高圧水銀灯）を用いて、400mJの紫外線を照射するこ

とにより硬化した。その上に同様にして、製造例1にて調製した減反射材用低屈折率層塗液をそれぞれ乾燥膜厚が、550nmで最小反射率を示すように調整してから塗布、硬化することにより減反射材を作製した。

【0080】得られた減反射材の最小反射率および表面抵抗値を以下のように測定した。結果をそれぞれ表2に示した。

最小反射率：導電性減反射材の裏面をサンドペーパーで荒らし、黒色塗料で塗りつぶしたものを分光光度計

（「U-best 50」、日本分光株式会社製）により、400～700nmの5°、-5°正反射スペクトルを測定した。そして反射スペクトルから反射率の極小値を読みとり、最小反射率とした。

表面抵抗値：表面抵抗計（「DSM8103」、東亜電波工業株式会社製）により測定した。

【0081】実施例8～12

組成物Aに代えてそれぞれ組成物（B、C、D、E、F）を用いた以外は実施例7と同様にして減反射材を作製した。また実施例7と同様に減反射材の最小反射率および表面抵抗値の測定を行った。結果をそれぞれ表2に示した。

【0082】比較例4～6

組成物Aに代えてそれぞれ組成物（G、H、I）を用いた以外は実施例7と同様にして減反射材を作製した。また実施例7と同様に減反射材の最小反射率および表面抵抗値の測定を行った。結果をそれぞれ表2に示した。

【0083】

【表2】

表2

	実施例						比較例		
	7	8	9	10	11	12	4	5	6
組成物の種類	A	B	C	D	E	F	G	H	I
組成物の硬化後の屈折率	1.68	1.70	1.71	1.68	1.71	1.73	1.62	1.77	1.74
最小反射率(%)	0.9	0.7	0.6	1.0	0.6	0.4	1.3	0.3	0.4
表面抵抗値(Ω)	3.5×10^9	7.6×10^9	1.5×10^{10}	6.5×10^{11}	8.0×10^9	4.0×10^{10}	0.8×10^9	4.4×10^{13}	3.8×10^{12}

【0084】実施例7ないし実施例12において、製造された減反射材は最小反射率1%以下、かつ帯電防止機能を兼備している。それに対して比較例4では反射率が高く、比較例5、6では帯電防止能が十分で無いことがわかる。

【0085】

【発明の効果】帯電防止に優れ、かつ高屈折率な膜を形成することが可能な高屈折率導電性材料用組成物が得ら

れる。また高屈折率導電性組成物の硬化物を備えた透明導電性材料は、屈折率が1.65以上となり、高屈折率である。またその表面抵抗値は $10^9 \sim 10^{12} \Omega$ の範囲にあり、帯電防止に十分な表面抵抗値を示している。また高屈折率導電性材料用組成物の硬化物を減反射層中に用いた減反射材は最小反射率1%以下、かつ帯電防止機能の優れた性能を示す。

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